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USAF • PERT

VOLUME II

PERT–TIME SYSTEM COMPUTER HANDBOOK

Programmer's Guide

ADVANCE COPY FOR AFSC IMPLEMENTATION

SEPTEMBER 1963

FOREWORD

This manual is Volume II of the USAF PERT series. It is the companion publication to Volume I, USAF PERT Time System Description Manual, dated September 1963.

This document provides a programmer-oriented description of the IBM 7090 computer program used to process data for systems and projects employing the USAF PERT Time methodology.

Additionally, this program provides the schedule information required for operation of the USAF PERT Cost program. Consequently, this document is also a supplemental publication to Volume IV, USAF PERT Cost System Computer Program Handbook, Part II.

The requirements of both Air Force and Industry have been considered in developing this program. Therefore, comments concerning any part of this publication are solicited from both government and industry sources. Comments should be forwarded to Hq AFSC (SCCSS), Andrews AFB, Washington 25, D. C.

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DCS/Comptroller

USAF PERT

VOLUME II

PERT TIME SYSTEM COMPUTER HANDBOOK

Programmer's Guide

SEPTEMBER 1963

USAF has produced a series of PERT documents to provide understanding of the USAF PERT TIME and PERT COST Systems presently in use. This manual, Volume II, is the second in the USAF PERT series.

USAF PERT

VOLUME I	USAF PERT TIME SYSTEM DESCRIPTION MANUAL
VOLUME II	USAF PERT TIME SYSTEM COMPUTER HANDBOOK
VOLUME III	USAF PERT COST SYSTEM DESCRIPTION MANUAL
VOLUME IV	USAF PERT COST SYSTEM COMPUTER PROGRAM HANDBOOK, PART I
	USAF PERT COST SYSTEM COMPUTER PROGRAM HANDBOOK, PART II
VOLUME V	USAF PERT IMPLEMENTATION MANUAL

PREFACE

In recent years, the Program Evaluation and Review Technique (PERT) has been widely accepted by all types of industry and government agencies in an effort to establish uniform management practices and procedures to utilize EDPE in management. As a result of this rapid growth and the desire of individual companies to utilize and adapt PERT to their own peculiar requirements, many variations of reporting procedures and computation techniques have blossomed, even though the basic technique remains. These differences in reporting and computation are insignificant as long as they remain as in-house efforts. However, complications and cumbersome conversions arise when an effort is made to report program status to the controlling agency. This is particularly true in instances where the contractor may have contracts with more than one government agency or, more common, have contracts with different divisions of one command, such as BSD and ASD in the Air Force Systems Command. In fact, many contractors and agencies have stated that the system to be adopted must be uniform within all government/industry agencies. AFSC has been working with the DOD PERT Coordinating Group in an effort to attain a uniform PERT methodology which will be acceptable to both industry and government. It is realized that no individual company or government office can be completely satisfied with any one method. However, a uniform methodology should prove more satisfactory than a situation in which everyone is going in a different direction.

It is with these thoughts in mind that USAF PERT has been promulgated. The computer program being used has been written under the new IBM 7090 Operating System - Basic Monitor (IBSYS) and will be placed in the SHARE library. The many requirements of both Air Force and industry were considered in the development of USAF PERT. Every effort was made to retain the desirable features without overloading the program to the extent that required processing time would become prohibitive. A careful examination of the USAF PERT methodology should reveal that the program features desired by the majority of users have been incorporated.

The USAF PERT program has the following parameters and features:

- the program is capable of processing networks of up to 12,000 activities and/or events, whichever occurs first;

- activity and/or event titles are accepted and printed out;

- a master file is maintained on tape for successive update runs;

- when all activities leading into a common event have been given actual dates, the latest of these is taken as the actual occurrence date for that event;

- activities are not assumed to have been completed until reported;

- no activity can be reported completed until all prior events have been reported as having occurred and prior activities have been reported completed;

- duplicate activities are dropped during input validation;

- any event may have a scheduled date entered. This scheduled date is used as the expected date of occurrence in computing forward for all events without preceding activities (i.e., all beginning events of the network). If a scheduled date is not given to an event without a preceding activity, the network base date is used as the expected date in computing forward;

- there are three options for latest dates on all events without succeeding activities (end events). In order of priority, these are:

    - scheduled dates on end events are selected as latest dates;

  - a network completion date is selected for computation of latest dates for all end events without scheduled dates;

  - for those events not covered by the above options, the latest computed expected date for the network is selected as the latest date for each network end event.

- ordering and ranking of the activities of the network is accomplished internally;

- if an event has more than one critical predecessor, the program arbitrarily lists only one in the event output. Others may be found from the slack listing;

- the user has the option of selecting certain scheduled dates for backward computation. These scheduled dates may be selected anywhere in the network;

- the base date of the network for a given project or system is carried in the master file. This date must be equal to or earlier than any date of any event in the system;

- the calendar routine is based on a 5 day workweek with holidays excluded;

- networks are checked for loops;

- networks may have multiple beginning and ending events;

- input reporting is always by activities on AFSC Form 30. (Inputs are by activities even if an event output is required.)

- three time estimates for each activity are accepted. The program will also accept single activity time estimates.

- events without predecessors can be given actual completion dates.
- the program computes the probability of meeting scheduled dates.
- the program accomplishes automatic validation of input data.
- event, activity and graphical reports are available at the user's option. These can be ordered by slack, event/activity number, or by expected dates as desired.
- shredouts of any of these outputs may be selected.
- a listing of the master file after any run is available.
- the program has the option of selecting the shortest path on parallel efforts.
- the program produces a listing of paths with most positive slack.
- the program computes the probability of positive slack.
- an event standard deviation is calculated.
- a level code for events is included.
- the program possesses network integration and a summarization capability.
- there are no limitations to the number of changes to the master file.
- scheduled and actual dates may be entered on the initial run.

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USAF PERT TIME PROGRAM DESCRIPTION

CHAPTER I

USAF PERT TIME PROGRAM DESCRIPTION

A. What is PERT?

PERT (Program Evaluation and Review Technique) is a management technique which permits the use of electronic data processing equipment in planning, evaluating and analyzing the schedule development of a research and development program. The technique requires the formulation and development of a sequenced network of the many tasks necessary for the attainment of a final objective. Each task is independently analyzed for an estimate of the time it will require for its completion. The computer program computes the expected completion dates for each task and points out how each task fits into the overall program timewise. Thus, PERT does the following for management:

- requires the development of an overall system plan which identifies all areas of work - responsibility - and a time-phased integrated plan;
- reduces the overall picture to a manageable size;
- pinpoints critical areas in the development plan or schedule -- both areas that are "most" critical in meeting scheduled dates and areas that are "least" critical in the scheduled network.
- allows suggested modifications of program plans to be analyzed through the use of simulation procedures, before actually putting them into practice.

B. Definition of Terms

A clear understanding of each of the following terms is necessary for comprehension of the entire PERT program since all further definitions and discussions evolve from these basic terms. A complete glossary of symbols, standard abbreviations, and terms will be found in Appendix D.

Activity:

A work effort of a program which is' represented on a network by an arrow. An activity may also simply represent a connection of interdependency between two events in the network. An activity cannot be started until the event preceding it has occurred. Activities are designated by their end points which are two event numbers.

Beginning Event (BE)

The event which signifies the beginning of the actual work that occurs during an activity.

Ending Event (EE)

The event which signifies the ending of the actual work that occurs during an activity.

An activity starts with its beginning event and ends with its ending event. An event can be a beginning event for one or more activities and also an ending event for one or more activities. If the same event is an ending event for more than one activity, the event occurs only when all these activities have been completed.

Event

A specific definable accomplishment in a program plan, recognizable at a particular instant in time. Events do not consume time or resources. Events are designated by distinct 8-digit numbers (numeric only). The program will not accept an event number of all zeros.

Expected Elapsed Time (t_e)

A statistically weighted average time estimate, incorporating the optimistic (a), most likely (m), and pessimistic (b) time estimates for the work to be accomplished:

$$t_e = \frac{a + 4m + b}{6}$$

Network

A flow diagram consisting of the activities and events which must be accomplished to reach the program objectives, showing their planned sequence of accomplishment, interdependencies, and interrelationships.

Standard Deviation of an Activity (σ)

A measure of variance about the expected elapsed time for an activity, calculated when using three time estimates. It is computed from the formula:

$$\frac{b - a}{6}$$

Time Estimates

Three time estimates may be associated with each activity. These are:

- Optimistic Time Estimate (a)

  The time in which the activity can be completed if everything goes exceptionally well. It is estimated that an activity would have no more than one chance in a hundred of being completed within this time.

- Most Likely Time Estimate (m)

  The most realistic estimate of the time an activity might consume. This time would be expected to occur most often if the activity could be repeated numerous times under similar circumstances.

- Pessimistic Time Estimate (b)

  An estimate of the longest time an activity would require under the most adverse conditions, barring acts of God.

C. The PERT Network

The computer accepts as input a list of all the activities that form the network. These activities are defined by their beginning and ending events and three (or one) time estimates. In addition, a starting date for the entire system is given, and if desired, an ending or completion date of the system can be given.

The computer program will then create an ordered activity list such that for any activity on the list, all activities prior to it in the network will precede it on the list. Stored on this ordered list are the computed values of the expected time and standard deviation for each activity. From this list a forward event list is created which includes the expected date, critical predecessor, and standard deviation for each event.

The EXPECTED DATE (T_E) for each event is the date on which the event is expected to occur. It is calculated by adding to the start date of each beginning event of the network the activity times along each individual path up to the event under consideration. The latest of these computed dates is the expected date of completion for the event.

The start date of each beginning event of the network is determined as follows: If a scheduled completion date is given (scheduled completion dates will be discussed later) for the event, that date is taken as a start date. If no scheduled completion date is given, the starting date for the entire network will be taken as the start date for that event. The calculation of expected dates is based on the two assumptions that an activity starts as soon as its beginning event occurs, and an event occurs as soon as all activities leading up to it have been completed.

The CRITICAL PREDECESSOR (CP) for each event is the event which immediately precedes the event under consideration and is on the most time-consuming path leading to that event. This critical predecessor enables one to trace backward from any event to an initial event, thus determining the most '.ime-consuming path up to that point. This most time-consuming path with respect to an event is designated as the critical path for an event. Even though it is possible to have two or more critical paths leading to an event, this program will only identify one critical predecessor for each event. To check for the possibility of two or more critical paths, one should investigate the slack listing (slack will be discussed later) to see if there are other events with the same slack but not on the indicated critical path.

The CRITICAL PATH of greatest interest usually is the most time-consuming path leading to the primary end event of the network. The events and activities along the critical path are those which put the most constraint on the entire system. This is the most time-consuming path of all paths leading to the ending event. This suggested interpretation of critical path is subjective and is not restricted by this program.

An EVENT STANDARD DEVIATION is calculated by computing the square root of the sum of the squares of the standard deviations from each activity on the critical path up to the event under consideration. This event standard deviation is included in the final output of a run. It is also used in calculating the probability of meeting given scheduled completion dates.

The LATEST ALLOWABLE DATE (T_L) is the latest date on which an event can occur without creating an expected delay in the completion of the network. Latest allowable dates are computed by passing through the network in reverse order. The T_L value for a given event is calculated by subtracting the sum of the expected elapsed activity times (t_e) for the activities on the longest path from the given event to the end event of the network from the latest allowable date for completing the network.

A latest allowable date is associated with each end event of the network (each event which has no successor event) in one of the following ways:

- If a scheduled completion date is given (scheduled completion dates will be discussed later) for any end event, that date becomes the event's latest allowable date;

- If a scheduled completion date for the entire network is given, all end events that have no given scheduled completion dates will be given the network's scheduled completion date;

- If neither an event scheduled completion date nor network scheduled completion date is given, the computed expected date for the latest network end event is taken as the latest allowable date for every network end event.

A SCHEDULED COMPLETION DATE OVER LATEST ALLOWABLE DATE OPTION may be selected (see activity card format). Whenever this option is selected for an event, the scheduled completion date for the event will replace the computed latest allowable date if it is earlier than the latest allowable date. All further caculations in the network will be anchored on the date selected. This option permits processing a network where all latest allowable dates are computed on the basis of meeting selected scheduled completion dates. This option may segment critical paths so that the most critical path might not run all the way from a beginning event of the network to an ending event, but rather only to some intermediate event having a scheduled completion date.

The expected date and the latest allowable date for an event constrain the event from each direction. SLACK is the time difference between the latest allowable and expected dates (T_L-T_E). It is one of the most useful features of PERT. Slack values can be positive, negative, or zero. Negative slack occurs when a scheduled completion date for a network end event falls before the expected date of that event. Negative slack can also originate within a network when the scheduled completion date over latest allowable date option is selected. This simply says that you may be unable to complete that portion of the system by its scheduled completion date based on your present time estimates. Zero slack will occur whenever a scheduled completion date, or the network scheduled completion date, coincides with the computed expected date of an end event or, as is frequently the case, whenever scheduled completion dates for end events and networks have not been specified. If a scheduled completion date for an end event or for the network is later than the computed expected dates, the network will have positive slack throughout.

With these alternatives in mind, the output of a PERT run is analyzed by looking at the slack column for the minimum slack value listed. Then all the events that have this minimum slack value are identified. These events are on a critical path of the network. If these events are traced throughout the network, they form a continuous path. (The path can be traced by starting with the end event of the set; its critical predecessor will be another event of the set. Look up the critical predecessor of the second event, etc.) Since this path is the most time-consuming path in the network, the activities on this path are the ones that must be examined and monitored first to insure completion of the system by the scheduled completion dates of the end events. In order to shorten the computed expected dates of the end events, especially in those cases where these dates are later than the scheduled completion dates, time must be gained on the critical paths leading to these end events.

If the minimum slack value is positive, this "positive slack in the system" means the scheduled completion dates of the end events fall after the expected dates of these events and there is spare time available in the entire system. A "zero slack" condition, when the minimum slack value is zero, occurs most often when no scheduled completion dates for end events are given.

If the minimum slack value is negative there is "negative slack in the system" and the scheduled network completion dates are not likely to be met, depending on the amount of negative slack.

With reference to activities, the following terms need further explanation. The EXPECTED END TIME of an activity is equal to the expected time of its beginning event plus the activity's expected elapsed time. The EXPECTED END DATE is this time converted to a date. The LATEST END TIME of an activity is the latest allowable time of its ending event and the LATEST END DATE is this time converted to a date; therefore, latest end dates of activities are the same as latest allowable dates of their ending events. But expected end dates for activites do not necessarily correspond to an event expected date. When the activity is on a critical path, the expected end date will be the same as the ending event's expected date.

ACTIVITY SLACK is equal to the activity's latest end time minus its expected end time. The activity slack is always greater than or equal to the slack of the activity's ending event.

The computation of dates needs further clarification. The program computes a time in tenths of weeks from the given base date for the expected and latest times for each event. These times, printed in weeks, are included in the activity output. The activity expected end time and activity latest time (expected end time and latest time on an activity output) are given in weeks from the given base date of the system.

D. Additional Considerations

In addition to the beginning and ending event numbers and the time estimates required for each activity as input, a TRANSACTION CODE (TC) must be included before the network can be processed by the computer. This code describes the action to be taken on the activity. When TC is 1, the activity is treated as a new activity to be added to the network. When TC is other than 1, this indicates some other action must be taken with respect to that activity. See Section E for a complete discussion of transaction codes.

A SCHEDULED COMPLETION DATE is a date by which the initiators would like a particular event to be completed. Generally, a scheduled completion date is given only for major events in the system, not necessarily for all events. As indicated above, a scheduled completion date when given to an end event of the network is taken as a latest allowable date. Each scheduled completion date and the computed probability of meeting this date are included in the output. This probability is based on a normal distribution where the mean is taken as the expected date of completion of this event and the standard deviation is the event standard deviation described in Section C above. If the scheduled completion date is the same as the expected date, the probability of meeting this date is 0.50. If the scheduled completion date is earlier than the expected date, the probability of meeting the scheduled date is less than 0.50.

Since the program accepts information in terms of activities, the scheduled completion date for an event can be included with any one of the activities whose ending events are the particular event in question.

To associate a scheduled date with a beginning event of the network, a scheduled date transaction code (TC = 3) must be used with the event in the ending event field and the scheduled date in the date field (see Section E for further information).

Scheduled completion dates influence the expected and latest allowable date computations only when they are given to a beginning or ending event of the network, or when the "scheduled completion date over latest allowable date option" is selected. Whenever an end event of the network is given a scheduled completion date, this scheduled completion date is taken as the latest allowable date and is printed out in both the scheduled and latest date columns.

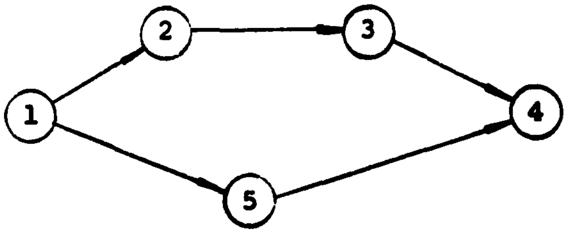
Another feature of the program is the inclusion of the ACTUAL DATE on which an activity is completed. On successive PERT runs, various activities are completed. As these activities are reported complete, the actual date is accepted as input (see Section E for a description of the way an actual date is included in the program) and carried as an actual date of completion for the activity. This activity may be one of several activities having the same ending event (EE). If this is the case, the program computes the expected date of (EE) along all possible paths. The expected date of occurrence along the path which includes the completed activity is taken as this actual date. The latest of all these dates is chosen as the expected date of occurrence of the event. When an actual date is given for all activities leading up to a particular event, the latest of these actual dates will be used as the actual date of completion of the event and will be included in the output. Then this event no longer has an expected or latest allowable date and hence no computed slack, standard deviation, or probabilities. The actual date is used as the event's expected date for the purpose of computing the times forward from this event.

Note again that an actual date is given for each activity, but an actual date is assigned to an event only after all activities leading up to that event have actual dates.

Logically, when an event is given an actual date (i.e., all activities leading up to that event have actual dates) all events preceding this event in the network should also have been given actual dates. If an actual date is given to an activity whose beginning event has not occurred on a previous run or will not occur on the current run, a diagnostic will indicate that the beginning event is missing an actual date. All actual dates are checked in turn and any other events that should have actual dates also will be indicated. The program will print out a diagnostic warning for each erroneous event. Then the network will be processed using all actual dates. A further identification of those events that are missing actual dates appears in the event slack output where the events are listed at the end of the list with "ERROR" printed in the slack column. Transaction code 4 is used to assign an actual date for an activity and transaction code 6 is used to assign an actual date for beginning events of the network.

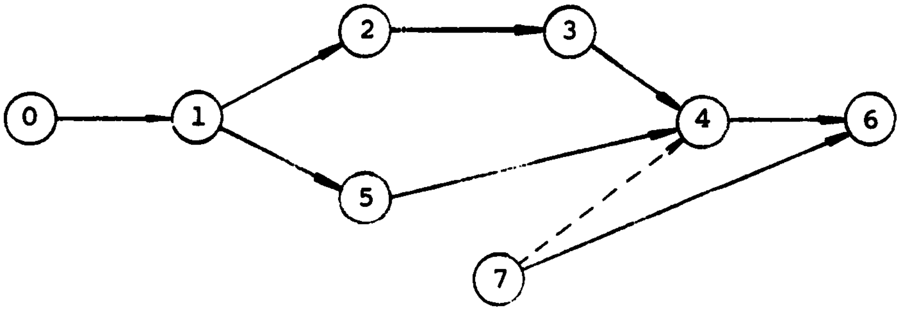
A LEVEL CODE (LC) can be used to shred-out specified events or to indicate events to be considered for summarization. The level code can be any letter, A through O, and will be printed on event printouts immediately following the event number to which it is assigned. The level code is assigned to an event number whenever it appears on an input card. It need be included only once. If two different level codes are given for the same event, an indication of this will be printed out and the second level code will be assigned to the event number. In the activity outputs and the master file report, the level code will appear only with the activity that it appeared with on the input card.

The possibility for carrying on parallel work toward the same goal with the intent of accepting the first successful effort from two or more attempts can be accounted for in the program. In PERT language, this means the expected date for certain events should be selected as the earliest date instead of the latest date from all paths leading up to that event. This is done by inserting a one in the SHORT PATH FLAG (SP) field of all activities at the termination of the parallel effort in completing an event. This short path flag will appear in the output with the terminating event. For example, in the following network:



If paths 1-2, 2-3, 3-4, and 1-5, 5-4 represent two parallel efforts to complete event 4, a short path flag (a "one") must be included with activities 3-4, 5-4 to indicate the end of the parallel effort.

The program does not allow any other activities to end with event 4. That is, parallel efforts must be considered separately from other interactions. Dummy activities can always be introduced if there are other tie-ins with event 4. For example:



If activity 7-4 represents an additional but not parallel effort necessary for the completion of event 4, it can be included by introducing activity 4-6, with zero time estimates and now representing the additional effort with activity 7-6 instead of 7-4. The expected time for 6 will represent the longer of the two expected times along 4-6 and 7-6 where the expected time for 4 is the minimum of the two times along 3-4 and 5-4.

TITLES can be given to events and/or activities in this program. Event titles are included in the input format for activity cards. Activity titles are included with an input card with a "9" transaction code. See Section E for additional information concerning event and activity titles.

In addition, 4 fields of activity-associated information can be input to this program with the "9" transaction code. These four fields can be used as a basis for various shredouts of the outputs. This input is also discussed further in Section E.

A computation of the probability of positive slack is included in the program. For each event, an expected date and standard deviation are calculated. Also, a latest allowable date and corresponding standard deviation are calculated. The latest allowable date minus the expected date is the slack for the event. Slack can be negative, zero or positive. The probability of positive slack is based on an assumed normal distribution of slack about zero with a standard deviation equal to the square root of the sum of the squares of the standard deviation of the expected and latest allowable dates. The probability of positive slack is equal to the area under the normal curve from minus infinity up to the computed slack value. Thus, if slack is zero, this probability is .50; if slack is positive, this probability is between .50 and 1.00.

E. Input

AFSC Forms 30 and 30A (the continuation sheet) are the only forms required for operation with the USAF PERT TIME System. These forms are used for initial entries as well as for periodic updating cycles. AFSC Forms 30 and 30A are shown in Figures A-5 and A-6 respectively in Appendix A. Separate forms must be prepared for each network to be processed. The data on the Form 30 is transcribed onto punched cards and is used to establish a network master file or to update an existing master file.

The following paragraphs contain the detailed instructions for preparation of AFSC Forms 30 and 30A. A condensation of these instructions is printed on the reverse side of Form 30, as shown in Figure A-5b.

The Form 30 has two data areas:

> The initial card information at the top of the form represents the job order or instructions to the computer for a particular run.
>
> The transaction cards portion of Form 30 which is continued by the use of Form 30A accepts the network information for activities and/or events.

A one-line entry is used for each activity or event. When it is desired to use activity titles and other special activity identification to supplement the information provided by a single-line entry, two lines are used to record the complete information for each activity.

Initial Card

Following is a description of the data columns on the AFSC Form 30 used for initial card preparation. The top portion of Figure A-5a is filled out only once for a particular run since it contains the instructions for what should be printed out in that run.

Column 1-7: Report Date. (ddmmmyy) e.g., 01JAN63. This is the cutoff date for the report and is primarily used to establish the currency of the network. It is printed out in the heading of all final output reports. In addition, it is used as the starting point of the E-L Chart. Hence, it must be given and must be later than the start date if this report is requested.

8-9: Run Number. The run number must be 01 for an initial run and greater than 01 for update runs. If the run number is 01, tne program does not search for an old master file. For any other run number the program calls for an old master file and prints out the run number. The program does not check to see if run numbers are sequenced.

10: Special Program Options. The options in this column have been used to aid in debugging the computer program. They are still available and are listed below.

NOTE: This column is for use by computer programmers only.

Blank - Normal PERT run.

1 - Core dump on SYSOU1 after Input Routine. Program halts.
2 - Core dump on SYSOU1 after Rank Routine. Program halts.
3 - Core dump on SYSOU1 after Forward and Backward Routine. Program halts.
4 - Core dump on SYSOU1 after Event Output. Program halts.
5 - Core dump on SYSOU1 after Activity Assembly. Program halts.

11: Blank - Not used.

12: Master File Report. This is a listing of the current network.
Blank - PERT Master File Report not requested.
1 - PERT Master File Report requested.
2 - Changed items from PERT Master File Report requested.

13-18: Start Date of the Network. (mmddyy) e.g., 013063 for Jan. 30, 63. The start date of the network must always be given. This date is the point from which all time calculations are made. Like the report date, the start date is printed out in the heading of all final output reports.

19: E-L Chart - By Weeks.
Blank - No E-L Chart requested.
1 - E-L Chart with D - - D spread.
2 - E-L Chart with D - - D spread omitted. A report date must be given if an E-L Chart is desired, since it is used as the starting point for the chart.

20: Summary Report. This code indicates whether a summary report is desired and designates the level of the summary. When a certain level is designated, all higher levels of summary

will also be printed out. The letters "A" through "O" and the number one may be used.
Blank - No summary requested.
1 - Minimum summary. A summary network containing only those events required to maintain the network logic of the detailed network.
A - Summary on level A requested.
B - Summary on levels A and B requested.
C - Summary on levels A, B, and C requested.
  -
  -
  - etc., through
O - Summary on levels A, B, C, . . ., O requested.

21: <u>Event Output Options</u>. A code number (1 through 7) is entered to indicate the type of event output desired.
Blank - No event output.
1 - Event output ordered by event number.
2 - Event output ordered by expected date.
3 - 1 and 2.
4 - Event output ordered by slack.
5 - 1 and 4.
6 - 2 and 4.
7 - 1, 2 and 4.

22: <u>Blank</u> - Not used.

23: <u>Run Date</u>. This is the actual processing date and is taken from SYSDAT which is a computer storage location established by the $ DATE monitor card or by the facility's accounting routine through IBSYS.
Blank - Run date is included in the output.
1 - Run date omitted.

24: <u>Blank</u> - Not used.

25-30: Network Completion Date. (mmddyy) e.g., 013063 for Jan. 30, 1963. The network completion date is an optional date that is assigned as a latest allowable date (T_L) to all end events which do not have assigned scheduled completion dates. If the network completion date is not given, computed expected dates (T_E) are used to set T_L for end events.

31-36: System Number. (First line, first field of output heading - 6 alpha-numeric character field). This specifies the system number that will be printed in the heading of the selected output reports.

37-72: Output Title. (First line, third field of output heading - 36 alpha-numeric character field). This field may be used as desired. The entries will appear in the output heading.

73-78: User's Identification. (Second line, last field of output heading - 6 alpha-numeric character field).

79: E-L Chart - By Months.
Blank - No E-L Chart requested.
1 - E-L Chart requested.

80: Activity Output Options. A code number (1 through 7) is entered to designate the type of activity output desired.
Blank - No activity output.
1 - Activity output ordered by ending/beginning event numbers (EE-BE).
2 - Activity output ordered by activity expected end time.
3 - 1 and 2.
4 - Activity output ordered by activity slack.
5 - 1 and 4.
6 - 2 and 4.
7 - 1, 2, and 4.

Transaction Card Input Data (for first line of information)

The following explanation pertains to the data portion of Forms 30 and 30A as used for recording the first line (first punch card) of information for each activity. Examination of Figure A-5a will show how this entry is made. The columns below refer to the columns on the Form 30 and those on the corresponding punch card.

Column 1: Transaction Code. Transaction codes are used to indicate the action to be taken in processing each line entry. The following codes are used:

TC-1: Code 1 indicates a new activity to be added. All activities for the first run of a network will have this code with the exceptions cited under TC-3.

All fields of the "Input Format for Activity Cards" are applicable. Scheduled dates may be included with any activity and will be automatically associated with the ending event of the activity. Actual dates cannot be entered with this code.

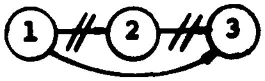
TC-2: This code indicates a change in any one or all of the three time estimates for an existing activity. The new time estimates replace the former ones. If the time estimates are left blank, no change in the previous estimates is made. This code is also used to change the interface flags and/or level codes. If columns 5, 14, 15, or 24 are blank, nothing is done to the interface flags or level codes. A zero in any of these columns will delete the corresponding interface flag or level code. An "I" in columns 5 or 15 will add an interface flag for the corresponding event, and a letter "A" through "O" will add a level code for the corresponding event. To change an interface flag or level code, this 2 code must contain the same activity as was used initially to establish the interface flag and/or level code. (This does not apply when adding a new interface flag or level code.) If the level code or interface flag was assigned to an event more than once, a 2 code must be used with each activity that contained the flag or code. When using this transaction code, column 3 must be blank, and the activity must be defined by its two event numbers in columns 6-13 and 16-23. Columns 5, 14, 15, 24, and 25-36 are used as mentioned above. All other columns are not used.

TC-3: A 3 code is used to add, change, or delete a scheduled date, to add or change the scheduled date over latest date option, and/or to add or change the title of a particular event. This might be considered an event information code. The program will take the event number from columns 16-23, and if a scheduled date is given, store that date and the scheduled date/latest date option with the event number. If any character of the title field is not a blank, the program takes the information from columns 44-78 of this input card as a description of the event and stores this title for output.

This card code enables one to give a description and a scheduled date to initial events and, hence, might appear in an initial run along with the transaction code 1 cards. To change only the scheduled date over latest date option associated with a scheduled date which has previously been included in the network, the scheduled date must again be inserted into the network by being punched in columns 37-42 of this card together with the desired option in column 3. A blank omits the option and a "1" includes this option in the computation. When a scheduled date is changed with this card, the scheduled date option for the new scheduled date is taken from column 3 of this card. To delete a scheduled date, zeros must be placed in all columns of the date field. Only columns 1, 3, 16-23, 37-42, and 44-78 are used by the program.

TC-4: This code is used to establish an actual date of completion for an activity. The date is assigned to the ending event of the activity. A date of completion will not appear in the output for this ending event until all activities with the same ending event have reported dates of completion. Then, the latest completion date which the computer received will be included in the output as the actual date of completion for the ending event. Only columns 1, 6-13, 16-23, 37-42 are used by the program.

TC-5: Code 5 is used to delete an activity. The only information needed is the beginning and ending event numbers. Care must be used with code 5 to maintain the desired network. For example to delete an event linking two activities to a network, two activities must be deleted and one added.



to delete Event 2, one must delete Activities 1-2 and 2-3 and add a new Activity 1-3.

Only columns 1, 6-13, and 16-23 are used by the program.

TC-6: Code 6 is used to add an actual date and if desired to add a title to a beginning event of the network. The date must be greater than or equal to the start date of the system. If only the event title is to be added, a TC-3 code should be used. The only information which a TC-6 card needs is the event number in columns 16-23. the actual date in the date field (columns 37-42) and, if included, the title in columns 44-78.

TC-7: Code 7 is not used at this time.

TC-8: Code 8 is used to add or delete a short path flag of an activity. The beginning and ending event numbers must be given together with the new short path flag (blank or 1). Special care must be exercised in using the short path flag.

TC-9: Code 9 is only used when activity titles or associated data are entered on the second line of activity information. This is not used for the first line of activity information.

Column 2: Short Path Flag.
Blank - No short path flag.
1 - Short path flag is desired. If this flag is used all terminal activities of a parallel effort must be identified with a "1" (one) in this column.

3: Scheduled Date Option.
Blank - The scheduled date is not included in the latest allowable date computation.
1 - The scheduled date is included in the latest allowable date computation. The program will replace the computed latest

allowable date with the scheduled completion date if it is earlier than the latest allowable date (T_L) and continue computing latest allowable dates with this new restraining date.

4: Blank - Not used.

5: Interface for Beginning Event.
Blank - The beginning event is not an interface.
I - The beginning event is an interface.

6-13: Beginning Event Number (BE) - must be numeric and greater than zero. All columns must be filled.

14: Level Code for the Beginning Event. A letter "A" through "Ø" (the latter should be written "Ø" to distinguish it from zero which is used in the same column for deletion purposes) is used to identify the beginning event for various management levels for summary or shredout purposes. The level code need be included only once for each event.
Blank - No summary level designated.
A - Ø - As assigned.
O - (number zero) - delete the level code.

15: Interface for Ending Event.
Blank - The ending event is not an interface.
I - Ending event is an interface.

16-23: Ending Event Number (EE). Must be numeric and greater than zero. All columns must be filled.

24: Level Code for Ending Event (A through Ø). A letter "A" through "Ø" (the latter should be written "Ø" to distinguish it from zero which is used in the same column for deletion purposes) is used to identify the ending event for various management levels for summary or shredout purposes. The level code need be included only once for each event.
Blank - No summary level designated.

A - Ø - As assigned.
0 (number zero) - delete the level code.

25-28: Optimistic Time Estimate. In weeks and tenths of weeks. (003.5 equals a time of 3 1/2 weeks). Four digits must be used.

29-32: Most Likely Time Estimate. In weeks and tenths of weeks. (003.5 equals a time of 3 1/2 weeks). Four digits must be used. When single time estimates or scheduled times are used, they are placed in these columns only.

33-36: Pessimistic Time Estimate. In weeks and tenths of weeks. (003.5 equals a time of 3 1/2 weeks). Four digits must be used.

37-42: Date Field. These columns are used to enter a scheduled date for an event or actual completion date of an activity. The date Jan. 30, 1963, would be entered as 013063.

43: Blank - Not used.

44-78: Event Title. The ending event title may be entered in this field. Alphabetic, numeric, or other special characters available can be used to describe an event. To include a title with a starting event, a transaction code 3 must be used.

79-80: Blank - Not used.

Transaction Card Input Data (for second line of information).

The use of data columns on Forms 30 and 30A for the second line entry (second punch card) which records additional activity information (activity title and special activity identification such as responsible organization or department, charge number, priority number, etc.) is described below. Figure A-5a illustrates how this second line entry is made when using only one of the four available fields of activity information. The data entered as a second line will be printed on the second line of the Activity Reports. (See Appendix A for examples).

Column 1: The transaction code to enter activity titles and activity associated information is always 9.

2-5: Blank - Not used.

6-13: Beginning Event Number (BE).

14-15: Blank - Not used.

16-23: Ending Event Number (EE).

24: Blank - Not used.

25-42: Activity Information. The activity associated information is divided into 4 fields; the first 3 fields contain 4 columns of information each and the 4th field can contain 6 columns of information. This division of the 18 columns is prompted by the AFSC Form 30, where these 4 fields correspond to the three time estimates and the date fields. These four fields are used at the discretion of the PERT user. Any information the user desires to associate with a given activity may be included. The information entered in any or all of these 4 fields will be printed on a second line of the Activity Report. Columns 25-42 may also be used to increase the title length.

43-78 Activity Title. The activity title may be entered in this field. Alphabetic, numeric or other special characters available may be used to describe an activity.

79-80 Blank - Not used.

F. Validation and File Maintenance Reports

1. PERT Master File Report Summary Sheet

The initial part of this PERT program generates or updates a master file tape from the input data whenever a network is to be processed. On every run a PERT MASTER FILE REPORT SUMMARY SHEET is printed out (see illustration in Figure A-7, Appendix A). This is a listing of information about the entire network and the optional outputs the user has requested. The information includes the User's Identification, System Number, Output Heading, Report Date, Start Date and the Report Options. There are five major report options available, with alternatives given for some of the options. The selection of these options is indicated under Report Options by the following symbols appearing under each major report option title:

MASTER - Indicates the selected master file report option.

- **Blank** - No master file report requested.
- **STD** - Standard master file report requested.
- **CHG** - Master file report requested for only those items from the master file that were affected by the last set of changes.

E-L CHART - Indicates the selected E-L Chart option.

- **Blank** - No E-L Chart requested.
- **WKS-D** - An E-L Chart by weeks with the "D"'s to show the three standard deviation spread was requested.
- **WKS** - An E-L Chart by weeks without "D"'s was requested.
- **MOS** - An E-L Chart by months was requested.
- **WKS-D MOS** or **WKS MOS** - E-L Charts have been requested under both options.

EVENT - Indicates the selected event output sort option.

- **SL** - Slack ordered sort requested.
- **ED** - Expected date ordered sort requested.
- **EN** - A sort by increasing event number requested.

ACTIVITY - Indicates the selected activity output sort options.

SL - Activity slack ordered sort requested.
ET - Activity Expected End Time ordered sort requested.
EN - Activity ending/beginning event number ordered sort, i.e., EE-BE requested.

SUMMARY - Indicates the selected summary report option.

Blank - No summary report requested.
A through letter O - A summary report summarized to the level of the letter shown was requested.
1 - Minimum summary network requested.

2. PERT Master File Report

A PERT master file report is printed next when requested. This is a listing of the updated network and can be used to check for errors. It includes the following information: TC, SP, SCH OPT, I, BEGIN EVENT, LC, I, END EVENT, LC, OPT TIME, M TIME, PESS TIME, SCH DATE, ACT DATE, and EVENT TITLE. On the second line is the activity title and/or other activity associated information. See Figure A-8, Appendix A, for an illustration of the PERT master file report.

3. PERT TIME Error Messages Report and PERT Diagnostics Report

The error messages report identifies errors, such as duplicate activities, changes to nonexistent activities, etc. The computer program also includes a list of diagnostics and comments which are printed when applicable.

Included are operation instructions and errors found after the master file generation phase. The possible error messages are listed in Figure I-1. The complete listing of PERT diagnostics is presented in Figure I-2. The comments appearing in lower case type in these tables are not printed out.

1. INCORRECT OLD MASTER SYSTEM NO XXXXXX
SYSTEM NAME (36 characters)
RESTART OR SKIP JOB

2. BE INCORRECT
Cause - the BE has alpha or blank characters.
Action - the record is omitted and computation continues.

3. EE INCORRECT
Cause - the EE has alpha or blank characters.
Action - the record is omitted and computation continues.

4. LC INCORRECT
Cause - the LC for BE or EE is other than an A through O or a blank.
Action - the LC is omitted and computation continues.

5. TIMES BAD
Cause - an alpha or blank is in the time field or an alpha is in the date field.
Action - the times are omitted and computation continues.

6. INSERT EQUAL
Cause - the same activity has been entered twice or more.
Action - the first entry is retained and all others are dropped.

7. SEQ ERROR
Cause - there has been a machine error in sorting.
Action - re-run.

8. UNMATCHED
Cause - an update has been entered for an activity or event that does not exist in the master.
Action - the update is omitted.

9. NONSELECT
Cause - the input card format is not correct.
Action - the input card is omitted and computation continues.

Figure I-1
Error Messages

1. LEVEL CODE CHANGE XX-XXX-XXX[1] L[2].
Cause - the level code indicated has been changed.

2. O TIME IS GREATER THAN P TIME. USES M TIME
XX-XXX-XXX TO XX-XXX-XXX.

3. O TIME IS GREATER THAN M TIME. USES M TIME
XX-XXX-XXX TO XX-XXX-XXX.

M TIME IS GREATER THAN P TIME. USES M TIME
XX-XXX-XXX TO XX-XXX-XXX.

5. INCORRECT TRANSACTION CODE T[3] XX-XXX-XXX.
Action - the input card is omitted and the run continues.

6. XX-XXX-XXX HAS MORE THAN 63 PREDECESSORS.
Action - the run is terminated.

7. XX-XXX-XXX HAS MORE THAN 63 SUCCESSORS.
Action - successor tally is 63 plus number shown.

8. START DATE IS NOT CORRECT.
Action - the run is terminated.

9. SCHEDULE OR ACTUAL DATE IS BEFORE THE START DATE.
DELETE DATE XX-XXX-XXX.
Action - event T_E is used in the computation.

10. NOE EXCEEDS 12000.
Action - the run is terminated.

11. NOA EXCEEDS 12000.
Action - the run is terminated.

12. LOOP IN NET. TAKE PROBLEM OFF MACHINE. LIKELY
EVENTS IN LOOP ARE (ALL EVENTS IN LOOP).

[1] XX-XXX-XXX - will be the event number that is in question.

[2] level code.

[3] transaction code.

Figure I-2a
PERT Diagnostics

```
13.     3SR05---3SR14
        Cause  - the network cannot be summarized due to
                 the density of selected events.
        Action - the summary run is terminated.

14.     TIME HAS EXCEEDED 15.7 YEARS (Expected or Latest Times).
        Action - the run is terminated.

15.     THESE ACTIVITIES HAVE ACTUAL DATES BUT THE "BE'S"
        ARE NOT COMPLETED (CHECK) XX-XXX-XXX.
        Action - the date is accepted but an indication
                 will be given for the BE's on all output
                 reports.  (The word ERROR will print in
                 the slack columns.)

16.     3SR01---3SR05
        Cause  - the case in 15, above has occurred.
        Action - the summary run is terminated.
```

Figure I-2b
PERT Diagnostics

G. Output Reports[1]

Headings

The event, activity and E-L Chart outputs each have basically the same heading at the top of each page (Figures A-10, A-13, A-15). The heading includes fourteen items; six on the first line and four items on each of the next two lines as follows:

1. SYSTEM NR. XXXXXX, taken directly from columns 31-36 of the initial input card.

2. Name of output - EVENT REPORT, ACTIVITY REPORT or E-L Chart.

3. Output heading, columns 37-72 of the initial input card.

4. RUN NR. XX, columns 8-9 of the initial input card.

5. PAGE NR. XXX, generated within the program.

6. Order of output. For the event output this ordering can be by EVENT, SLACK, or EDATE (expected date). For the activity output this ordering can be by EE-BE (ending event-beginning event), A SLK (activity slack), or E TIM (expected time). For an E-L Chart, the output is always ordered by event expected date.

7. START DATE XXXXXXX, taken from columns 13-18 of the initial input card and converted to the (ddmmmyy) format.

8. USAF PERT

9. XXXXX EVENTS, the number of events.

10. User's identification, columns 73-78 of the initial input card.

[1] the figure numbers shown in parentheses throughout this section refer to illustrative examples given in Appendix A.

11. END DATE XXXXXXX, taken from columns 25-30 of the initial input card and converted to (ddmmmyy) format.

12. RUN DATE XXXXXXX, taken from SYSDAT.

13. XXXXX ACTIVITIES, the number of activities.

14. REPORT DATE XXXXXXX, a duplication of columns 1-7 of the initial input card.

Event Output (figures A-10, A-11, A-12)

One may select this output ordered by event number (item 2 below), expected date (item 8 below) or slack (item 11 below). Fourteen items of information for each event are included in the event output listing as follows:

1. EVENT TITLE

2. EVENT NR. An "I" will be printed out immediately preceding the event number if that event has been designated as an interface event on the input form.

3. L.C. - Level Code of above event.

4. CRITICAL PREDECESSOR

5. L.C. - Level Code of the Critical Predecessor Event.

6. S.P. - The Short Path Flag.

7. ACTUAL DATE

8. EXPECTED DATE

9. LATEST DATE

10. SCHEDULED DATE - An asterisk will precede this date when the scheduled date over the latest date option is selected.

11. SLACK TIME, given in weeks.

12. STD DEV, the event standard deviation in weeks.

13. PROB SCD, the probability of meeting the scheduled date.

14. PROB POS SL, the probability of having positive slack.

Activity Output (Figures A-15, A-16, A-17)

One may select this output ordered by EE-BE (items 1 and 3, below), by A SLK (item 11, below), or by E TIM (item 5, below). The following items of information are included in the activity output:

1. BEGINNING EVENT, the beginning event of the activity. An "I" will be printed out immediately preceding the event number if that event has been designated as an interface event on the input form.

2. LC, the level code of the beginning event.

3. ENDING EVENT, the ending event of the activity. An "I" will be printed out immediately preceding the event number if that event has been designated as an interface event on the input form.

4. LC, the level code of the ending event.

5. EXPECTED END TIME, the activity expected end time in weeks from the base date (or start date - they are the same). If an A precedes this time; the time and date are activity actual times and dates from transaction code 4.

6. EXPECTED END DATE, the activity expected end time converted to a date.

7. LATEST END TIME, the activity latest end time in weeks from the base date. If an A precedes this time, the time and date are actual times and dates for the ending event.

8. LATEST END DATE, the activity latest end time converted to a date.

9. ACT TIME, the activity expected time (a + 4m + b)/6.

10. ACT SIG, the activity standard deviation, (b-a)/6.

11. ACT SLACK, the latest time of the activity's ending event minus the activity expected time.

12. SCHEDULED TIME, the activity scheduled time.

13. SCHEDULED DATE, the activity scheduled date. An asterisk will precede this date when the scheduled date over latest date option is selected.

14. CRITICAL PREDECESSOR, the event which immediately precedes the event under consideration on the most time-consuming path leading to that event.

15. SP, short path flag.

16. EVENT SLACK, the slack of the ending event.

17. END EVENT EXP DATE, the expected date of the end event. This will be equal to or later than the date shown in item 6. An "A" preceding this date indicates an actual date.

Whenever activity titles and/or activity associated information are given, this will be printed on a line immediately below the above items.

<u>E-L Charts</u> (Figure A-13, A-14).

The E-L Chart is a chronological display of the expected (E), latest (L), scheduled (S), and actual (A) times for each event in the network. This display begins at the time of the report date, which must be the same as or later than the start date. All events with expected dates prior to the report date but without actual dates will be listed without reference on the chart. Only those events with expected dates within the range of chart will be listed.

The event title and number, together with its slack value and an "E" for the expected date and an "L" for the latest date will be printed for each event within the time span of the chart. Whenever an event has been given a scheduled date, an "S" is also printed with that event. Whenever a symbol (E, L, S) is printed, the date itself is also printed. When an actual date for an event falls within the time span of the chart, the date will be printed and labeled as "ACTUAL DATE". The E-L Chart may be selected for either or both of two time spans. The first extends for a period of one and one-half years in weekly increments. This chart may be selected with or without a "D" printed three standard deviations to the left and to the right of the "E". The time period for the second chart covers the report date and the following 84 months. The "D's" are not available on this report.

H. Network Summarization

The capability of summarizing a network is included in the USAF PERT TIME Program. One purpose of this summary is to allow the processing of several large networks as one integrated network by condensing these networks so that they may all be processed together (i.e., so that the total number of activities or events on the integrated network will not exceed 12,000). The first step in this direction is to develop from any given network a smaller summary network that, when processed either alone or together with other networks, will give the equivalent results with respect to its events and activities (some newly defined ones) as would be achieved if the original network was used. To achieve this goal, several rules were established concerning the selection of events to be included in the summary. These rules require the following events to appear on a summary network:

1. Designated events.

2. Interface events.

3. Start events.

4. Ending events.

5. Completed events that are beginning events of at least one incompleted activity.

6. If any of the above events is the beginning event of a completed activity, the ending events of all incompleted activities for which the above is a beginning will be included.

7. All events that are ending events of both a completed and an incompleted activity will be included.

8. All beginning events of the completed activities in 7 above.

The method of selection of these events must be explained. First of all, column 20 of the initial input card will be used to indicate whether a summary has been requested. If column 20 is blank, no summary is requested. If it is not blank, it may be an A, B, C, D, --- corresponding to level codes of A through O. This will be interpreted as requesting a summary including all events with level code "A" through and including the letter used in column 20. Thus, a B means summarize and include all events with level codes A or B.

From the above list, those designated events are simply all events with level codes in the range indicated by column 20 of the initial input card. A 1 in column 20 will produce a minimum summary network that does not include any events from this category.

Next, it was found that regardless of the level code, all interface events must be included in the summary. Hence, all events which are also part of another network (i.e., interface events) must be designated with an I in the column preceding the event number in at least one of the input cards. An interface event may have any level code, but will be included in all summaries.

Network start and end events will be determined by the program itself. Any event which is not an ending event to any activity is considered a network start event and similarly any event which is not a beginning event to an activity is considered a network end event. Networks can have multiple start and end events.

Events defined by items 5 through 8 of the above list will all be determined by the program itself. The events in each of these categories have had to be included in order to retain the equivalent restraints imposed on the original network. These events must all be selected because some events or activities in the neighborhood of each of these events have been completed causing a mixture of constraints due to actual dates and computed expected dates.

This summarization will produce a new network in terms of activities in a format identical to the normal input to this PERT program. The summary program will write on tape card images with each card representing an activity and having the necessary parameters such as the transaction code, event numbers, time estimates, etc.

CHAPTER II

COMPUTER PROGRAM DESCRIPTION

CHAPTER II

COMPUTER PROGRAM DESCRIPTION

The USAF PERT TIME System uses electronic data processing equipment to process time and associated data. Standard sort, file maintenance, input and output and monitor routines are utilized by the program. The program is broken into several independent sections. Each section can be assembled alone and then inserted into the total program or all sections can be assembled as one unit.

The employment of the standard control routines and sectioning of the program makes it fairly simple to make additions and/or changes to the program.

USAF PERT was programmed for the IBM 7090 computer since this machine was available at ASD, BSD, and SSD. The program meets the requirements of the features and parameters cited in the preface to this volume. The program makes maximum usage of the computer's 32,768 word core memory and 16 tape units on two data channels. Information is stored in many fields within the core memory. The assignment of these fields, the assignment of tapes and the order of their usage, together with a descriptive outline of the several jobs that make up the program are presented in this chapter. A tape assignment chart for 16 tape units is included at the end of the chapter.

Comments on the changes required to run on a 7090 with fewer tape units will be found in the tape assignment section.

A. Word Format of Lists Used

PEN	Pseudo Event Number List	
	1st Digit	S, 1-3
	2nd Digit	4-7
	8th Digit	28-31
	Level Code (LC)	32-35
ACT 1	First Work on Activity List	
	Rank (R)	S, 1-11
	Standard Deviation (Activity)	12-20
	Beginning Event Number (BE)	21-35

ACT 2	Second Word on Activity List	
	Short Path Flag	S
	Summary Controls	
	Interface Flag for BE	1
	Interface Flag for EE	2
	Summary Level Code Flag for BE	3
	Summary Level Code Flag for EE	4
	Blank	5-6
	Actual Date Flag (Activity)	7
	Activity Time (TE)	8-20
	Ending Event Number (EE)	21-35
SDL	**Scheduled Date List**	
	Short Path Flag	S
	Event Actual Date Flag	1
	Scheduled Date Option Flag	2
	Illegal Actual Date Flag	3
	Event Title Flag	4
	Successor Tally (ST)	5-10
	Actual Date Tally (AD)	11-16
	Predecessor Tally (PT)	17-22
	Scheduled Time (SCT) or Beginning Event Actual Time	23-35
FEL	**Forward Event List**	
	Standard Deviation (SIGF)	S, 1-8
	Critical Predecessor (CP)	9-22
	Expected Time (ET) or Actual Time (AT)	23-35
BEL	**Backward Event List**	
	Standard Deviation (SIGB)	S, 1-8
	Interface Flag	9
	Blank	10-20
	Sign Bit for Latest Time	21
	Latest Time (LT) or Actual Time	22-35

B. Master File Maintenance Routine

The Master File Maintenance Routine consists of four phases which perform the functions of file establishment (when requested), file update, master file reporting (when requested), and error reporting of unprocessed change cards.

PHASE 1A

This FAP-IOCS program creates a dummy master file when a 01 appears in the run number positions (columns 8-9) of the parameter card. This file establishment procedure consists of writing the 9PAC dictionary (a 50 word record) followed by an end of file and the parameter card on the blank old master tape. The change cards are then read into the computer to be sorted on the ending event number (major), beginning event number (intermediate), and the transaction code (minor) either internally or externally. The collating sequence is as follows: blank, all other characters, zero, 1, 2, 3, 4, 5, 6, 7, 8, 9. Only blanks and numeric characters are allowed. Any other character appearing in an event number or transaction code will cause the entire card to be omitted in Phase 2A. If there are less than 2000 update cards, the cards are sorted with an internal sort routine and written on the output tape after which the 90 sort control cards are skipped and control is passed to Phase 2A. For a larger data deck, the change cards are copied on a scratch tape and control is returned through the Basic Monitor to Phase 1B.

The following steps describe the programming sequence in phase 1A:

1. Define the input and output buffers.

2. Attach the files to the IO-buffers pool.

3. Open the SYSIN1 file and the SYSOU1 file.

4. Read the 9PAC dictionary cards into DICT. If the number of cards doesn't agree with the programmed number print an error message "Deck is not correct - update sort terminated."

5. Close the SYSIN1 file. Set tags OFFLG and INOPN to 0. Open the UPDAT file. Set tag UPOPN to a non-zero number. Set tags ARRAY thru ARRAY + 28 to 0.

6. Read the first 6 words of the parameter card from the UPDAT file into ARRAY + 4 thru ARRAY + 9. Then read the next 8 words of the parameter card into ARRAY + 18 thru ARRAY + 25.

7. If the number in columns 8-9 of the parameter card is not greater than 01, go to step 20; otherwise continue.

8. Set tags XR1 to 2, XR2 to ARRAY + 28, XR3 to 1, and ARRAY + 17 to 1.

9. Read in one update card. If EOF, go to step 14; otherwise advance XR1 by 1 and if OFFLG does not equal zero, go to step 13; otherwise continue.

10. Count the update cards and transfer the update cards to ARRAY + 28 thru ARRAY + T1 where T1 equals TOP minus the last address of program and TOP equals the last address in memory minus 64.

11. If XR1 is less than or equal to MAXUP-1 where MAXUP equals T1/14, go to step 9; otherwise continue.

12. Set OFFLG ≠ 0 and write the update cards that are in memory on the OFFIL file and return to step 9.

13. Write the update card on the OFFIL file and go to step 9.

14. If OFFLG does not equal 0, go to step 19; otherwise sort the update cards via the internal sort (WDSORT) routine.

15. Write the sorted update cards on the STFIL file.

16. Skip over the external sort control cards, (Phase 1B) and close the STFIL file.

17. If the last card to be skipped was not an END card, print the error message on the event tape "Deck is not correct. Update sort terminated," and on line print "PERT cannot continue." If an END card was found, continue.

18. Close all open files and exit to IOCS. Note that if step 16 was not executed, then the next job will be to sort the OFFIL file via 90SORT, (Phase 1B); otherwise the next job is 9PAC (Phase 2A).

19. Close the OFFIL file and go to step 18.

20. Open the OLDMST file, write the dictionary file onto the OLDMST file and close the OLDMST file with an EOF.

21. Write the parameter card onto the OLDMST file as the first record of the second file and write the message "File establishment performed on SYSOU1" and go to step 8.

PHASE 1B (External Sort)

The 7090 SORT program will perform a sort of the tape produced by Phase 1A to produce a sequenced output tape for Phase 2.

The programming sequence is brief:

> Establish control cards for 7090 SORT. The logical record length for this SORT is 14 words and the physical record length is 10 logical records. The block size for the SORT is 70 physical records. Use a second order merge with 3 central fields. The central fields in order are TC, EE, and BE. The commercial collating sequence is used.

PHASE 2A (9PAC File Maintenance)

After the change cards are sorted, a 9PAC program will create a new master file by adding the change cards to the old master file. It simultaneously generates a tape of event numbers to be used by the pseudo event number generator and if requested by a punch in column 12, will produce a master file report. Update change cards which cannot be processed by this phase are written on a separate tape to be processed by Phase 2B. At the start of this phase, the system number and output heading on the change parameter card are checked against the old master parameter card to insure that the proper file has been mounted.

The following steps describe the programming for this phase:

1. Copy the 9PAC dictionary from the old master file to the new master file. This makes the first file on the new master file tape complete.

2. Read the new parameter card (2 records) from the update file and compare columns 31-72 with the corresponding columns from the old master file. If these columns don't match, print an error message both on and off line indicating a mismatched update file and stop.

3. Update columns 1-30 of the parameter card from the old master file and write it onto the new master file.

4. Write on the output tape a PERT Master File Report Summary Sheet. This sheet includes the Users Identification, System Number, Output Heading, Report Date, Start Date and the Report Options - all from the parameter card.

5. Read the next update card. If an EOF is reached, jump to step 18. Otherwise, validate the card.

6. If an error is found, write the card on an error file and return to step 5; otherwise continue.

7. If the sequence number of the update record is greater than the sequence number of the master file record, the master file record is written on the new master file tape and if a master file report was requested as output, this record is also written on the output tape. Another record is read in from the old master file tape and if an EOF is reached jump to step 18; otherwise return to step 7. If the sequence number of the update record is not greater than that of the master file record, continue.

8. If the transaction code of the update record is 1, jump to step 9. If TC equals 2, jump to step 10, if 3 go to step 11, 4 to step 12, 5 to step 13, 6 to step 14, 8 to step 15 and 9 to step 16. All other possible transaction codes will have been declared invalid.

9. If the current update record is not the same activity as that of the current master file record, add this update record to the new master file and if an output report was requested, write this record on the

output tape also. Return to step 5. If the two activities do match, jump to step 17.

10. If the two activities match, update the record from the old master file as indicated by the 2 transaction code. Write this record into the new master file and, if requested, onto the output tape. Read in another record from the old master file and return to step 5. If the activities do not match, jump to step 17.

11. Check to see if the BE field is blank. If not, go to step 17. Otherwise, write a TC 3 code record onto the new master tape and, if requested, the output tape. Read in another record from the old master file and return to step 5.

12. If the two activities do not match, jump to step 17. Otherwise, add an actual date to the old master file record and write this record on the new master file and, if requested, the output tape. Read in another old master file record and return to step 5.

13. If the two activities do not match, jump to step 17. Otherwise, read in another record from the old master file and return to step 5.

14. If the BE field is not blank, jump to step 17. Otherwise, write a new TC 6 code record onto the new master file tape and, if requested, the output tape. Read in another old master file record and return to step 5.

15. If the two activities don't match, jump to step 17. Otherwise, update the old master file record and write it onto the new master file tape and, if requested, the output tape. Read in another record from the old master file and return to step 5.

16. Same as step 15. Update by adding activity information. NOTE: Additional validity checks are made in steps 10 thru 16. Invalid update records cause a jump to step 17.

17. Write this record onto the error tape and return to step 5.

18. Copy the remainder of the old master file tape onto the new master file tape. Rewind and unload the old master tape. Rewind the new master tape. Go to Phase 2B.

PHASE 2B

The error tape generated in Phase 2A is read in and an error report is generated on the output tape. This report prints out one of the following 8 messages with each rejected update card: BE Incorrect, EE Incorrect (an alpha character will cause either of these), LC Incorrect (anything other than a letter A thru O will cause this message), Times Bad (an alpha punched in a time field or an illegal date will cause this message), Unmatched (any update card without an original in the old master file), Insert Equal (a new activity identical to one already in the file), Nonselect (an illegal TC), and Seq Error (caused by not having blanks in the BE field for a TC of 3 or 6).

The programming consists of establishing 9PAC control cards to define the proper fields for printing out of the error tape generated in Phase 2A.

C. Input Routine

This routine reads the input.records from an updated master file, assigns pseudo event numbers, creates a scheduled date list, creates an activity list and prepares for network summarization if requested. The pseudo event numbers require a Pseudo Event Number (PEN) list of up to 12,000 words and the scheduled dates require a Scheduled Date List (SDL) of 12,000 words.

A PEN list word will consist of the 8 digit event numbers, packed 4 bits per digit in the left 32 bits of the computer word. The position on the list of an event number becomes the pseudo event number. The event level code, if it is given, will be converted to a number 0 thru 15 and stored in the right 4 bits of the word.

The Scheduled Date List will be oraered by pseudo event numbers (hence each word on the list corresponds to a particular event whose pseudo event number is equal to

Logical Records are 24 words

Physical Records are 10 Logical Records

FIRST RECORD (From the initial card)								SUCCESSIVE RECORDS						
Footnote	Contents						Word No.	Footnote	Contents					
1	00	01	00	00	00	00	1	1	00	02	00	00	00	00
	Not	used					2	2	TC	SP	SO		BI	BE_1
	Not	used					3	3	BE_2	BE_3	BE_4	BE_5	BE_6	BE_7
	Not	used					4	4	BE_8	LC	EI	EE_1	EE_2	EE_3
	Not	used					5	5	EE_4	EE_5	EE_6	EE_7	EE_8	LC
10	Da.	Da.	Mo.	Mo.	Mo.	Yr.	6	6	a	...		a	m	...
11	Yr.	RN	RN	CK		MF	7	6	...	m	b	...		b
12	Mo.	Mo.	Da.	Da.	Yr.	Yr.	8	7	Mo.	Mo.	Da.	Da.	Yr.	Yr.
13	EI	SM	EO		CC		9			Event Title			(ET)	...
14	Mo.	Mo.	Da.	Da.	Yr.	Yr.	10		ET	...				
15	SN	...				SN	11		ET	...				
	Output Title			(OT) ...			12		ET	...				
	OT	...					13		ET	...				
	OT	...					14		ET	...				
	OT	...					15	8	Mo.	Mo.	Da.	Da.	Yr.	Yr.
	OT	...					16	9	AF_1	...		AF_1	AF_2	...
	OT	...				OT	17	9	...	AF_2	AF_3	...		AF_3
16	UI	...				UI	18	9	AF_4	...				AF_4
17		AO					19		Activity Title				(AT)	...
	Not	used					20-24		AT	...				

1. Word number 1 of each record is a 9PAC control word.
2. TC-transaction code, SP-short path flag, SO-scheduled date option, and BI-interface code for BE.
3. BE_i-ith digit of the beginning event number.
4. LC-level code, EI-ending event interface code.
5. EE_i-ith digit of the ending event number.
6. a-optimistic time, m-most likely time, b-pessimistic time.
7. Scheduled date.
8. Actual date.
9. AF_i-a character of the ith word of the activity associated information.
10. Report date.
11. RN-run number, CK-checkout flag, MF-master file report indicator.
12. Start date.
13. EL-E-L chart report indicator, SM-summary report indicator, EO-event report indicator, CC-clock indicator.
14. End date.
15. SN-system number.
16. UI-users symbol or name.
17. AO-activity output indicator.

This tape is recorded in binary.

Figure II-1
Master File Tape Format (Second File)

its position on the list) and will contain an event nomenclature indicator, a successor tally, actual date tally and predecessor tally. These tallies indicate the number of activities which immediately succeed the event, the number of activities which immediately precede the event and have been given actual dates, and the number of activities which immediately precede the event. When given, an actual time for beginning events and a scheduled time for any event is stored in this list.

The pair of activity words contain the activity pseudo event numbers, the activity expected time or actual date, the activity standard deviation, the short path flag, summary controls and the actual date flag.

The following steps describe the programming sequence:

1a. Read in the initial card information from the master file. Read in the event number tape and create a partial PEN list. This partial list contains all the event numbers from the ending event field of the master file. Set NOE and NOE1 to the number of events in this partial list. If the summary is requested (column 20 not blank), set a summary switch for step 6.

b. Read a logical record from the master file. If EOF jump to step 19. Otherwise go to step 2.

2. Check the transaction code (TC).
If TC equals 1, jump to step 3.
If TC equals 3, jump to step 16.
If TC equals 4, jump to step 17.
If TC equals 6, jump to step 18.
If TC is other than the above, jump to a diagnostic to indicate an incorrect TC. Since transaction codes 2, 5, 8 and 9 have been merged into the master file, they do not appear here.

3. Add 1 to NOA (Number of Activities). If NOA is greater than 12,000, print a message and stop. Otherwise continue.

4. Pack the actual BE into one word and the actual EE

into anothe r word in bits, S, 1-31. Enter the PEN subroutine with BE. Store the pseudo BE (referred to henceforth just as BE) in the address portion of ACT 1. Next convert EE to a pseudo EE (referred to henceforth just as EE) and store in the address portion of ACT 2.

5. Check the level code of BE. If it is blank jump to step 6. Otherwise convert this 6 bit code to a 4 bit code as follows: A equals 0, B equals 1, . . . 0 equals 14, Z equals 15. Locate PEN + BE and mask out bits 32-35. If bits 32-35 equals 15, mask the new 4 bit code into (PEN + BE) and jump to step 6. If bits 32-35 ≠ 15, check to see if the level code in the PEN word equals the new bit code. If it does, jump to step 6. If it doesn't, check to see if the new level code came from a Z. If so put 15 in bits 32-35 of PEN word and jump to step 6. Finally, if the new level code is not a Z, mask the new 4 bit code into (PEN + BE), print out a message indicating a change in the level code and jump to step 6.

6a. Check to see if EE has a level code (col 24 other than blank). If so, repeat step 5, returningto this point. If the summary switch is not set, jump to step 6b. Otherwise, if the interface field for the beginning event (col 5) is a one, mask a "one" into bit 1 of the ACT 2 word. If the interface field for the ending event (col 15) is a one, mask a "one" into bit 2 of the ACT 2 word. If the level code for the beginning event is within the summary level, mask a "one" into bit 3 of the ACT 2 word. If the level code for the ending event is within the summary level, mask a "one" into bit 4 of the ACT 2 word.

b. Return to step 17 if this path has come from there. Otherwise continue.

7. If the optimistic time estimate, a, is blank, convert the most likely time, m, to binary tenths of weeks and set t_e equal to m and SIGMA equal to 0. Jump to step 9. If a is not blank, continue. Convert a, m and b to binary tenths of weeks from BCD.

If a is not less than or equal to m and/or m is not less than or equal to b, jump to a diagnostic printout. This diagnostic will print out the actual BE-EE and the type of error and return back to this point in the routine. Replace a and b with m and continue. If the above test passes, jump immediately to step 8.

8. Compute (a + 4m + b)/6 and store the rounded integral result in the t_e field (bits 8-20) of ACT 2. Compute the standard deviation (b-a)/6 and store the results, rounded to xxx.x (octal) in bit positions 12-20 of ACT 1.

9. If the PT tally equals 63.0, print out an error message, PT tally exceeds limit and stop. If PT does not equal 63.0, continue. Add 1 in bit 22 of the Scheduled Date List at address (SDL+EE). This adds one to the predecessor tally (PT), a tally of the number of activities leading into event EE.

10. Test to see if a schedule date is given by checking the date field for blanks. If not blank, then a date is given. If bit 1 of (SDL+EE) is 1, (flag set by step 16) jump to step 11. Otherwise pack this date in one word and enter the DTOT (Date-to-time) subroutine. Store the result in bits 24-35 of (SDL+EE). Mask the Scheduled Date over the Latest Date Option flag from column 3 to bit 2 of (SDL+EE).

11. If thc ST tally exceeds 63.0, print out an error message, ST tally exceeds limit. Set ST to "Zero" and continue. If ST does not equal 63.0, continue. Add 1 to bit 10 to the Scheduled Date List at address (SDL+BE). This adds one to the Successor Tally (ST), a tally of the number of activities leading out of event BE.

12. Pack the Short Path flag (0 or 1) in bit S of ACT 2. If bit 2 of (SDL+EE) is 1, set bit 4 of ACT 2 to 1. If bit 2 of (SDL+BE) is 1, set bit 3 of ACT 2 to 1. This causes BE and/or EE to be included in the summary if the scheduled date option applies to either event.

13. Send ACT 1 and ACT 2 to an output buffer.

14. Zero the ACT 1 and ACT 2 words.

15. If no title is given for EE (columns 44-79 are blanks) go to 1b. Otherwise if a title had previously been given (bit 4 of (SDL+EE) equals 1) delete the current title (since the previous title has already been included) and return to step 1b. If there was no previous title write the packed EE (1 word) and the title on the event title tape. Put the title indicator in bit 4 of (SDL+EE). Return to step 1b.

16a. If the transaction code equals 3, this indicates a change in a scheduled date and scheduled date over latest date options (deletions and additions are considered changes) and/or in the title of an event. Convert only the ending event number to its PEN number, and convert its level code as described in step 5. If the scheduled date field is zero, set bit 1 of (SDL+EE) to 1 and jump to 16b. If the scheduled date field is blank, jump to 16b. Otherwise, convert and store this date and the scheduled date over latest date option on the scheduled date list as described in step 9.

b. Jump to step 15.

17. If the transaction code equals 4, this indicates a completed activity by giving an Actual Date. The Master File Routine will have deleted the corresponding input card with TC equals 1 for this activity and will have inserted all necessary information in this record. Reference the (SDL+EE) word, and add "1" to the AD field (bits 11-16). Store a "1" in bit 7 of ACT 2, the Actual Date flag field. Store the converted actual date from the 15th word of the Master File Activity Record in bits in 8-20 of ACT 2 and go to step 13.

18. A Transaction Code of 6 adds an actual date and/or a title to an event without a predecessor and converts the ending event's level code as in step 5. The date must be equal to or greater than the start date of the system. Once this date is assigned to

an event, the event cannot be given a scheduled date. Convert EE as described in step 5. Store the converted date from the 15th word of the Master File Activity Record on the Scheduled Date list. Advance AD of (SDL+EE) by 1 and return to step 15.

19. An end of file indicates that all records on the master file have been processed. Write PEN and SDL on tape. Rewind all tapes used by this program. If no activity outputs are requested, rewind and unload the new master file.

PEN Subroutine

This subroutine takes a packed event number and searches the PEN list to see if the number appears on the list. If it is found on the list, the position of the number on the list is taken as the event's pseudo event number. If it doesn't appear on the list, the packed event number is added to the list and again its position on the list is taken as the event's pseudo event number.

Since the partial PEN list generated by the Master File Maintenance Routine is ordered by true event numbers, a binary search technique can be used to determine whether an event E is on the list. If the event E is not found on the list, it must be a beginning event. It is either found to be one of the events appearing on the list starting at (PEN + NOE1) where NOE1 is the number of entries on the partial PEN list, or is added to this portion of the list.

1. Set LL (lower limit) to 1 and set UL (upper limit) to NOE1.

2. If E (bits S, 1-32) is less than the first entry (bits S, 1-32) or larger than the entry (bits S, 1-32) at (PEN + NOE1), go to step 5. Otherwise E must be in the ordered portion of the PEN list. Continue.

3. Compute LI equals (LL + UL)/2. If LI equals LL, the entry is not on the list; go to step 5.

4. Compare E with the entry at (PEN + LI). If E (again bits S, 1-32 only) is less than (PEN + LI), set UL equal to LI and go to step 3. If E is greater than (PEN + LI), set LL equal to LI and go to step 3. If E equals (PEN + LI), LI is the PEN number. Put LI in the accumulator and exit.

5. Subtract the length of the partial PEN list, NOE1 from NOE. This gives the number of events added to the partial list.

6. Compare E with the entries starting at (PEN + NOE1). If E equals one of the entries, the position of the entry is taken as the PEN number, the PEN number is left in the accumulation and an exit occurs. If E is not on the list, replace NOE by NOE+1. Leave this number in the accumulator as the number, and insert E on the list at(PEN + NOE). If NOE is greater than 12,000 print a message and stop. Otherwise exit.

D. Rank Routine

This routine computes a rank for each event, assigns each activity a rank based on its beginning event number and orders the activity list by rank and beginning event number (pseudo number).

1. Read in list of activities. Let RAD1 be the address of the first word of this list and RAD2 equals RAD1 + 12,000.

   Set RTW (Rank Test Word) equal to 0.
   Set RC (Rank Counter) equal to 0.
   If NOA is less than 6,000, go to step 2; otherwise, go to step 11.

2. Zero RAD2 thru(RAD2 + NOE).

3. Pass thru the activity list. For each activity select its BE and EE. Test to see if (RAD2 + EE) is greater than (RAD2 + BE). If not, transfer (RAD2 + BE) + 1 (in bit 11) to (RAD2 + EE). If (RAD2 + EE) is greater than RC, add 1 to RC.

4. If RC is greater than 1024, investigate those events in a loop. To detect those events in a loop take the present ranked list and find all those events which have ranks 1024, 1023, 1022, etc. until there is a rank for which no events exist. Store these events.

   Interchange beginning and ending event numbers and rank this inverted network. Select those events with maximum rank as was done above and establish a second list. Sort each list and select those events that are common to both. List these events out as events in the loop and exit from the program.

   If RC is less than or equal to 1024 continue. Replace the RTW by a non zero number, skip this replacement henceforth. Continue thru all NOA activities.

5. Test RTW equals 0. If so, jump to step 6; otherwise, set RTW equal to 0. Reset step 3 and return to step 3.

6. Now pass thru the activity list and add (RAD2 + BE) to the first word of each activity.

7. Order the activity by rank and beginning event number via an internal sort routine.

8. Write the ordered activity list onto tape L1.

9. Write the ordered activity list in reverse order onto tape J1.

10. Exit.

11. Zero all but the address portion of RAD1 thru (RAD1 + NOE).

12. Pass thru the activity list. For each activity select its BE and EE. If bits S, 1-11 of (RAD1 + EE) are greater than bits S, 1-11 of (RAD1 + BE) go to step 13. Otherwise transfer bits S, 1-11 of (RAD1 + BE) plus one in bit 11 to bits S, 1-11 of (RAD1 + EE).

13. If the number of bits S, 1-11 of (RAD1 + EE) is greater than RC, add one to RC.

14. If RC is greater than 1024, jump to step 4. Otherwise continue. Replace the RTW by a non zero number, skip this replacement henceforth. Continue thru all NOA activities.

15. Test if RTW equal to 0. If so jump to step 16; otherwise set RTW equal to 0, reset step 12 and return to step 12.

16. Zero all but bits S, 1-11 in RAD1 thru (RAD1 + NOE). Pass thru the second (NOA - 6000) activities assigning each a rank by adding to the first word of each activity the contents of (RAD1 + BE).

17. Write the second (NOA - 6000) activities in 250 word blocks onto tape and rewind.

18. Read the first 6000 activities from the activity input tape into RAD2.

19. Assign a rank to these 6000 activities by adding to the first word of each activity (RAD1 + BE).

20. Transfer these activities from RAD2 to RAD1.

21. Read the second (NOA - 6000) activities from tape into RAD2.

22. Order this list of activities by their rank and beginning event number.

E. Network Summarization Routine

The network summarization routine takes a detailed network and, based on some preselected events, constructs a summarized version of that network. Included in the summarized network are those preselected events plus events that are included by the program (called program-selected events) to insure network consistency. Generally the program will have to include time-now type events (events with both completed and incompleted paths leading into or out from them), and all start and end events. The following cases define in detail which events are selected by the program.

Case 1 - If an event is a start event, a preselected event, or a completed event, which has both complete and incomplete successor activities, then each incomplete successor event becomes a program selected event under case 1.

Case 2 - All completed events with at least one incomplete successor activity.

Case 3 - If a completed and incompleted activity merge and the predecessor event of the incompleted activity also lies on a path which constrains the predecessor event of the completed activity and there are no intervening selected events on this path, then the completed activity's predecessor event becomes a program-selected event.

Case 4 - All events which represent the merging of complete and incomplete activities. The inputs to this routine are the activities of the network in predecessor rank sequence and without that, predecessor number.

The basis of this routine is a Successor Event Table which contains 21-word blocks of information relative to an event. The initial block for an event contains 6 words of information concerning the event and is followed by up to 7 pairs of words, each referring to an event (possible milestone) which precedes the original event. (A milestone is an event which is included in the summary). If more than 7 milestones are found, additional 21-word blocks, each containing up to 10 milestones are set up. All blocks have in their 21st word the address linkage to the next block in the chain of blocks.

The Successor Event Table consists of blocks of 21 words each. All initial blocks have the format described below. A continuation block repeats the format of words 7 and 8 in words 1 thru 20 and contains another linkage address in word 21.

SUCCESSOR EVENT TABLE

WORD	BITS	CONTENT
1st	21-35	Event number.
2nd	S	Incomplete flag - Set to 1 if any activity leading into this event is not completed, otherwise equals 0.
	1	Complete flag - Set to 1 if any activity leading into this event is complete, otherwise equals 0.
	2-35	Number of summary events (preselected and program selected) which topologically precede this event.
3rd	S	Set to 1 if this event was preselected to be included in summary. Otherwise equals 0.
	1	Set to 1 if this event is program selected to be included in the summary under Case 1, otherwise equals 0.
	3-17	Address linkage to the block with the next complete successor.
	21-35	Address linkage to the block with the next incomplete successor.
4th	3-17	Address linkage to the block of the next event in this table.
	21-35	Address linkage to the block of the previous event in this table.
5th	S	Complete (actual date) flag - indicates whether the time in the 6th word is an expected (0) time or an actual (1) time.
	21-35	Predecessor event of present activity under consideration.
6th	S-12	Expected or actual time of present activity.
	17-34	Variance of present activity.
7th	S	Complete (actual date) flag - indicates whether the time in the next word is an expected (0) or an actual (1) time.

Successor Event Table - continued

WORD	BITS	CONTENT
	21-35	Event number of a selected event which topologically precedes this event.
8th	S-12	Expected time between this selected event and the block's event or actual time of completion of this constraint.
	17-34	Variance of this constraint.
	35	Set to 1 if the selected event is active. Set to 0 if the selected event is dead. An event is dead if another selected event lies on the same restraining path of this selected event and the block's event.

The odd words 9 through 19 and the even words 10 through 20 have the same format as words 7 and 8 respectively.

21st	21-35	Address linkage to next vacant block in this table if this block were vacant. Address linkage to next continuation block in this table if the information for this event exceeded the capacity of this block. Blank if this block contains the last set of information pertaining to its event.

The following symbols have been used in the program description and/or the program itself.

SMWA	Starting point of successor event table.
SMWB	Address of next vacant block in the successor event table.
SMWC	Input buffer area.
SMWC+1	Input buffer area.
SMWD	Predecessor event number.
SMWD+1	Successor event number.
SMWD+2	t_s and variance or actual time.

SMWD+3 Actual date flag - set to zero for no actual time.

SMWD+4 Select flag for the successor event - set to zero if not selected.

SMWE Previous predecessor event number.

SMWE+1 Address in the successor event table of the previous predecessor event.

SMWF Address of the previous event entered into the table.

SMWG Table address of the last incomplete successor event.

SMWH Select signal.

SMWI Case 3 signal.

SMWJ Output buffer area - contains variance and predecessor event number.

SMWJ+1 Output buffer area - contains actual date flag, t_e and successor event number.

SMWK Table address of the last completed successor event.

SMWL Predecessor selection indicator of previous predecessor.

SMWM Predecessor selection indicator of new predecessor.

SMWN End of file switch.

SMWP Merge count.

The following steps describe the programming sequence:

1. If column 20 of the parameter card is blank, exit. Otherwise continue.

2. Set up input and output files.

3. Set up linkages between the vacant 21 word blocks in the Successor Event Table (linkage in 21st word). This table is made as large as possible within the core memory.

4. Set a reference word SMWB to next available vacant block.

5. Read in and format the next activity via subroutine SMSA.

6. If the new predecessor (SMWD) equals the previous predecessor (SMWE) continue. Otherwise go to step 23. The record just read into core (assuming at this point that the program is somewhere in the middle of processing the Activity File) is tested to see whether the activity record's predecessor event is the same as the predecessor event of the last record prepared for processing; the object is to see whether another record of a predecessor-divergent group --- i.e., several activities stemming from the same predecessor event --- has been encountered. Note that all members of predecessor-divergent groups are processed as a group.

7. Since step 6 proved that the new record is a member of a predecessor-divergent group of activities, the Successor Table is scanned to see whether the new record's <u>Successor</u> Event has previously been encountered as a Successor Event, in earlier processing via subroutine SMSB. If the successor is not found, go to step 8. Otherwise jump to step 9.

8. Enter the successor in the next vacant block in the Successor Event Table via subroutine SMSC.

9. If the successor event is a preselected event (i.e., SMWD + 4≠0) set the sign bit of the 3rd word in the successor event block to 1 and go to step 10. Otherwise go to step 10.

10. If the activity is completed (SMWD + 3≠0), jump to step 12. Otherwise test to see if there were other incomplete successors; i.e., is SMWG (the locator of the previous incomplete successor) not equal to zero? If there were no others (i.e., if SMWG=0) go to step 11. Otherwise store the locator of the previous incomplete successor in 21-35 of the 3rd word of the successor event block.

11. Store the locator of this successor event in SMWG. Store the predecessor event number in the 5th word of the successor event block. Store the t_e and variance in the 6th word of the successor event block. Set bit S of the 2nd word of the block to 1 (one). Return to step 5.

12. SMWK contains the locator of the last completed successor. If SMWK=0, jump to step 13. Otherwise place this locator (from SMWK) into bits 3-17 of the 3rd word of the successor event block.

13. Store the locator of this successor event in SMWK. Store the predecessor event number (SMWD) in bits 21-35 of the 5th word of the successor event block. Set the sign bit of this word to 1 indicating a completed activity. Store the actual time in the 6th word of the block. Set bit 1 of the 2nd word of the block to 1. If bits 21-35 of the 3rd word of the block equal zero jump to step 5 since this successor event has no incomplete activities leading into it.

14. Determine whether the present predecessor is a start event by testing to see if the present predecessor is entered in the successor table, i.e., test is (SMWE+1)=0. If (SMWE+1) equals zero, jump to step 5. Otherwise initialize subroutine SMSD (reserve two words for output) and go to step 15 to begin searching for a previous milestone associated with this predecessor event.

15. Set up references to the next associated milestone to this present predecessor event via subroutine SMSD. The milestones listed in the present

predecessor in the successor table are examined, and the successor table entry for each of these milestones is referenced.

16. Return to step 5 if all milestones have been processed. Otherwise continue.

17. If the current milestone is not active (bit 35 of second word referencing this milestone=0) go to step 15. Otherwise continue. Once one is found which is flagged as a milestone it is tested to see whether it is flagged as "Active", i.e., whether there are no other milestones between it and this predecessor on the same dependency path. Initialize subroutine SMSD.

18. Set up references to the next associated milestone to this present successor event via subroutine SMSD.

19. Go to step 15 if all milestones have been processed. Otherwise continue.

20. Reference the current predecessor and successor milestone. If the milestones are not equal or if the successor milestone is complete, go to step 18. Otherwise continue.

21. Is the successor milestone active (bit 35 of the second milestone word = 1)? If it isn't active, go to step 15. Otherwise continue.

22. Set signal for Case 3 "on" (SMWI set to ≠ 0) and go to step 5. The "Case 3" flag is set in its "on" mode because the test has just indicated that the same milestone directly restrains the present successor via an incomplete path and the present predecessor via a completed path and, therefore, constitutes a "Case 3" condition. The program returns to step 5, to pick up another record.

23. At this point the new activity has a different predecessor from the previously processed activity. This new activity will be held in abeyance and the predecessor event of the previous activities will

henceforth be called the previous predecessor. If the previous predecessor is in the successor table (SMWE+1≠0) (i.e., is not a start event) jump to step 27. Otherwise continue. It must be determined whether there is a mixture of complete and incomplete successors to this event for Case 1. If the previous predecessor event does not have an incomplete successor (SMWG=0) go to step 26. Otherwise continue. If the previous predecessor event does not have a complete successor (SMWK=0) go to step 26. Otherwise there does exist a mixture. Continue.

24. Set up a reference to the incomplete successor block (SMWG).

25. Place a 1 in bit 1 of the 3rd word of this incomplete successor block. Pick up the address of the next incomplete successor from bits 21-35 of the 3rd word of this block. If this address is zero continue. Otherwise set this address as the address of the next incomplete successor block for the beginning of this step and repeat this step.

26. Turn "on" the selection signal (SMWH set to ≠ 0) and jump to step 51. This is done to force the program through the processing steps for program-selected events.

27. Reference the block in the Successor Event Table for the previous predecessor event. If the event is not complete (the sign bit of the second word = 1) jump to step 30. Otherwise continue since this event may be a "Case 2" event. If the event does not have an incomplete successor (SMWG=0) go to step 28. Otherwise if the event has no completed successors (SMWK=0) go to step 26. Otherwise go to step 26 since there is a mixture of complete and incomplete activities.

28. Since the test in step 27 disclosed that there were no incomplete activities leading from this previous predecessor event (i.e., no incomplete successors) this is not a Case 2 event. If the signal for Case 3 was "on" (SMWI≠0), go to step 26. Otherwise continue.

29. Reference the 3rd word of the previous predecessor block. If it is negative, go to step 26. This indicates the event was a preselected event and hence it isn't necessary to investigate whether this event might become a program selected event. Otherwise continue. If the predecessor selection flag (SMWL) is not zero, jump to step 26. Otherwise go to step 31.

30. Reference the 3rd word of the predecessor block. If bit 1 is 1, jump to step 26. This indicates the event is a program-selected event under Case 1. Otherwise continue. Reference the second word of this block. If there are both complete and incomplete activities leading into this predecessor event (i.e., both bits S and 1 are "1") go to step 26 (Case 4). Otherwise jump to 29.

31. If there are no completed successors (SMWK=0) jump to step 47. Otherwise store this locator SMWK for step 36.

32. Check to see if the previous predecessor (SMWE) equals bits 21-35 of the fifth word of the successor block referenced by SMWK. If not,alarm (this is just a check for a computer or program error). Otherwise continue. If the locator of the previous predecessor (SMWE+1) is zero (i.e., there is no block in the Successor Event Table), jump to step 44. Otherwise prepare to enter subroutine SMWD by storing zero and the locator (SMWE+1) in two successive words for reference by this routine.

33. Enter subroutine SMSD. This sets up references to the next milestone associated with the previous predecessor.

34. If all milestones have been processed jump to step 44.

35. Reference the current milestone associated with previous predecessor. If this milestone does not have an actual time (bit S in the first word of the 2 word block = 0) alarm because this is an incomplete

milestone preceding a completed activity. Otherwise initialize subroutine SMSD by storing zero and the locator of the activity's successor event in the successor table.

36. Enter subroutine SMSD. This sets up references to the next milestone associated with the previous complete successor. Note SMSD does not destroy previous references to the predecessor milestone.

37. If all milestones have been processed, go to step 43.

38. Reference the current milestone associated with the previous complete successor. If the two milestones from the predecessor and successor events are not equal, jump to step 36. Otherwise continue.

39. Is the milestone active relative to the predecessor event (i.e., is bit 35 of the 2nd word of the pair of words for this milestone a 1)? If not, go to step 41. Otherwise continue.

40. If the select signal is "on" (SMWH≠0) jump to step 41. Otherwise set bit 35 of the 6th word of the previous successor event block to 1.

41. Reference the actual time from the 6th word of the previous successor event block.

42. If the time in the 6th word of the successor event, i.e., the activity completion time, is less than or equal to the completion time from the selected milestone associated with this successor, jump to step 33. Otherwise replace the milestone's completion time with the completion time from the 6th word and jump to step 33.

43. Since the current milestone from the predecessor event does not match any milestones of the successor event, prepare to insert the current milestone into the successor event block. Reference the first vacant pair of words in successor block via subroutine SMSE. Store the first word of the current milestone

in the first vacant word just found. If bit 35 of the second word of the current milestone is a 1, put a 1 in the 35th bit of the 6th word of the successor event block. If the selection signal is "on" (SMWH≠0) store the 6th word with bit 35 equal to zero in the second vacant word just formed. If the selection signal is off, store the 6th word (including bit 35 whatever it might be) in the second vacant word of the successor event block. Jump to step 33.

44. If the selection signal is off (=0) jump to step 46. Otherwise continue. Initialize subroutine SMSE to reference the next vacant pair of words in the successor event block.

45. Since the selection signal is on, we want to establish the predecessor event as a milestone constraining the successor event. Reference the next vacant pair of words in the successor event block via subroutine SMSE. Store the previous predecessor event number (SMWE) in bits 21-35 of the first vacant word. Set the sign bit to 1 to indicate this is an actual date constraint. Store in the second vacant word the 6th word from the successor event block itself. Set bit 35 of the second vacant word to 1 to indicate an active predecessor milestone.

46. Reference the locator of the next complete successor from bits 3-17 of the 3rd word of the successor event block. If this locator is zero, jump to step 47. Otherwise this completed successor is now treated like the previous successor. The locator of this completed successor block is set up for use in step 36 in referencing the milestones to this event. This linkage (bits 3-17) is cleared. Jump to step 32.

47. If there are no incomplete successors (SMWG=0) jump to step 61. Otherwise set up a reference to the next incomplete successor for step 53.

48. Check to see if the previous predecessor (SMWE) equals bits 21-35 of the fifth word of the successor block

referenced by SMWG. If not, alarm (this is just a check for a computer or program error). Otherwise continue. If the locator of the previous predecessor (SMWE + 1) is zero jump to step 59. Otherwise prepare to enter subroutine SMWD by storing zero and the locator (SMWE + 1) in two successive words for reference by this routine.

49. Enter subroutine SMSD. This sets up references to the next milestone associated with the previous predecessor.

50. If all milestones have been processed jump to step 59.

51. Reference the current milestone associated with the previous predecessor. If the milestone does not have an actual date (bit S in the first word of the 2 words referencing the milestone = 0) jump to step 52. Otherwise test the selection signal (SMWH). If it is "off" (SMWH = 0) alarm (computer or program error). If it is "on" return to step 49. This will eliminate all future references to the milestone and thus divides the network into complete and incomplete activities.

52. Initialize subroutine SMSD by storing zero and the locator of the incomplete successor which was established in step 47.

53. Enter subroutine SMSD. This sets up a reference to the next milestone association with the incomplete successor.

54. If all milestones have been processed jump to step 58.

55. Reference the current milestone associated with the incomplete successor. If the milestones from the predecessor and successor events are not equal return to step 53. Otherwise continue.

56. Reference the t_e and variance from the second word of the milestone of the previous predecessor (in the previous predecessor's block) and add these to the t_e and variance from the 6th word in the previous incomplete successor block. If this sum is greater

than the t_e and variance in the second word jump to step 49.

57. If the selection signal is off return to step 49. Otherwise set the active bit (bit 35 of the 2nd word) to zero and jump to step 49. This milestone just associated with the previous incomplete successor event cannot be regarded as active (i.e., as directly constraining the successor event) because the predecessor intervenes between the milestone and the successor event.

58. Since the current milestone from the predecessor event does not match any milestones of the successor event, prepare to insert the current milestone into the successor event block. Reference the first vacant pair of words in successor block via subroutine SMSE. Reference the current milestone associated with the previous predecessor. Add the t_e and variance from this milestone to the t_e and variance from the 6th word of the successor event and store in the second word of the vacant pair of words just found. Store the milestone itself in the first word. Return to step 57.

59. If the selection signal is "off" jump to step 60. Otherwise initialize subroutine SMSE to reference the next vacant pair of words in the successor event block. Reference the vacant pair of words in the successor event block via subroutine SMSE. Store the 5th word of the successor event block into the first vacant word just found. Store the 6th word from this block with a 1 in bit 35 into the 2nd vacant word. Since the selection signal was "on," it was necessary to include the previous predecessor itself as an active milestone to the successor event.

60. Reference the locator of the next incomplete successor from bits 21-35 of the 3rd word of the successor event block. If this locator is zero jump to step 61. Otherwise this new incompleted successor is treated like the previous successor. The locator of this incomplete successor block is set up for use in step 53 in referencing the milestones of this event. The

linkage (bits 21-35) is cleared. Jump to 48.

61. If the select signal is "off" jump to step 66. Otherwise continue. Prepare to output all summary activities which terminate at the previous predecessor (if the selection signal is "on"). If the previous predecessor is not in the Successor Event Table (SMWE + 1 = 0) jump to step 70 (start event). Otherwise continue. Initialize subroutine SMSD by storing zero and the locator (SMWE + 1) of the previous block.

62. Enter the subroutine SMSD. This sets up a reference to the next milestone associated with the previous predecessor.

63. If all milestones have been processed jump to step 66.

64. If the milestone is not active (bit 35 of second word of milestone is 0) return to step 62 since summary activities are defined only from active milestones. Otherwise store this second word for output as the t_e or actual time of the summary activity. Store the milestone number itself for output as the predecessor event. Reference the previous predecessor event number (SMWE) and store it for output as the successor event for the summary activity.

65. Write out one restraint by subroutine SMSF. Jump to step 62.

66. This completes the processing of the predecessor event. Since the activity input records are sorted in predecessor rank sequences, once an event has been completely processed as a predecessor event it will never be encountered again. The block(s) can now be deleted from the Successor Event Table and the linkages updated. Reference the locator of the block to be deleted (SMWE + 1). If the address linkage to the block of the next event in this table (bits 3-17 of the fourth word) is not zero, jump to step 67. Otherwise store bits 21-35 of this word in SMWF and jump to step 68.

67. Store bits 21-35 of this fourth word into bits 21-35 of the fourth word of the block referenced by the next event (bits 3-17 of the above fourth word).

68. If the address linkage to the block of the previous event is zero (bits 21-35 of the fourth word), jump to step 69. Otherwise store bits 3-17 of this fourth word into bits 3-17 of the fourth word of the block referenced by the previous event (bits 21-35 of the above fourth word). Store (SMWE + 1) in (T1) temporarily.

69. Reference the 21st word from this previous predecessor block and store this address linkage (T2) temporarily. Store SMWB, the location of the next empty block, in this 21st word. Now store in SMWB the locator of this block (T1). If the above address linkage is zero (T2 = 0) jump to step 70. Otherwise store T2 into T1 and return to step 69.

70. Reset all flags. Zero SMWG, SMWH, SMWI, SMWK, and SMWL. If the last activity has been read in and processed (SMWN ≠ 0) jump to step 73. Otherwise store the new predecessor (SMWD) into the predecessor (SMWE) word. Test via subroutine SMSB to see if this predecessor (SMWE) is in the successor table. If it is, jump to step 71. Otherwise check to see if the address of the previous predecessor (SMWE + 1) is zero. If it isn't alarm. This check is made knowing that the new predecessor is a start event; hence no previous predecessor should exist. Otherwise go to step 7.

71. Store the table locator of this predecessor in SMWE - 1. Jump to step 7.

72. If an End of File is reached from subroutine SMSA turn the End of File flag "on" (SMWN ≠ 0). Jump to step 23.

73. If the address of the previous event in the table (SMWF) is zero, alarm since there must have been at least one entry in the table at this point. Store SMWF in temporary word T1.

74. Initialize subroutine SMSD by storing zero and T1, the locator of the last event entered in the successor table.

75. Enter subroutine SMSD. This sets up a reference to the next milestone associated with this event.

76. If all milestones have been processed jump to step 79.

77. If the milestone is not active (bit 35 of the second word of the milestone is zero) return to step 75. Otherwise store this second word for output as the t_e of actual time of the summary activity. Store the milestone number itself for output as the predecessor event of the summary activity. Reference the event number of this block (first word) and store it for output as the successor event of the summary activity.

78. Write out one restraint via subroutine SMSF. Jump to step 75.

79. Reference the 4th word of the successor table block of this last event, i.e., test for additional ending events. Store the address of the block of the previous event in the table (bits 21-35 of this word) in Tl. If bits 21-35 are not zero jump to step 74. Otherwise continue.

80. Close the input file and rewind the tape. Close the output file but don't rewind. Exit.

Subroutine SMSA

This routine unpacks the two activity input words as follows:

1. Read the next pair of activity words. If an End of File is reached jump to step 72. If a tape redundancy is encountered print an error message and exit.

2. Store the information from these two words into SMWD through SMWD+4 as follows:

SMWD	BE
SMWD+1	EE
SMWD+2	t_e, variance
SMWD+3	Actual Date Flag
SMWD+4	Selection Flag for EE

3. Store the selection flag for the previous BE in SMWL. Store the selection flag for EE in SMWM. Return to the main program.

Subroutine SMSB

This routine determines whether the event whose number is in the accumulator is in the Successor Event Table.

1. If the table is empty return to the main program without a successor table reference. Otherwise continue.

2. Reference the address of the last assigned block.

3. Compare event numbers. If they are equal return to the main program with the locator of the block. Otherwise if bits 21-35 of the 4th word of this block are zero, return indicating an unsuccessful search. If not, reference another block through bits 21-35. Return to step 3.

Subroutine SMSC

This routine inserts an event into the Successor Event Table.

1. If there is not room in the successor table (SMWB=0) alarm. Otherwise continue.

2. Zero the first 20 words of the next available block (referenced by SMWB).

3. Store the 21st word of this block in SMWB to indicate the next available block.

4. Zero this 21st word.

5. Reference the block of the last event entered into the table (SMWF). If this is zero jump to step 8. Otherwise continue.

6. Store the locator of this new event's block in bits 3-17 of the 4th word of the block of the last event entered into the table (referenced by SMWF).

7. Store the locator of the last event entered into the table (SMWF) into bits 21-35 of the 4th word of this new event block. Zero bits 3-17 of this new event block so that there will be no forward linkage.

8. Store locator of this new event block in SMWF. Store the event number itself in the first word of this new block. Return to the main program.

Subroutine SMSD

This routine references the next available milestone associated with an event in the Successor Event Table.

1. If this is an initial entry to the subroutine (the milestone = 0) go to step 2. Otherwise jump to step 3.

2. Reference the number of milestones associated with this event (the second word of the event's block). Advance this number by one and store as a milestone count. Store 8 for the block count. Set up the milestone locator as the event block locator plus 4 (thus it is set to reference the 5th word of the event block).

3. If the milestone count is equal to (or less than) one, jump to step 6. Otherwise reduce the milestone count by one. If the block count is equal to (or less than) one, jump to step 5. Otherwise reduce the block count by one and add two to the milestone locator.

4. Locate the milestone and alarm if it is zero. This indicates a program or machine error. Otherwise return to the main program with another milestone locator.

5. Set the block count to 10. Reference the linkage address (the 21st word of the event block) and store this linkage as the new milestone locator. If the locator is zero, alarm. This indicates a program or machine error. Otherwise go to step 4.

6. All milestones have been located. If the next milestone is not zero, alarm. This indicates a program

or machine error. Otherwise return to the main program without a milestone locator.

Subroutine SMSE

This routine references the next vacant pair of words to insert a new milestone associated with an event in the Successor Event Table.

1. Add one to the number of milestones associated with this event (the second word of the event's block). Retain this number for step 2 and also store it back into the event's block.

2. If the new number of milestones is greater than 7, subtract 7 from this count and jump to step 4. Otherwise add 4 to the event block locator.

3. Compute the locator of the next vacant pair of words as the event block locator, plus two times the number of milestones. Jump to step 6.

4. If a linkage to another block does not exist (21st word equals zero) jump to step 5. Otherwise reference the event's continuation block through this linkage. This linkage becomes the event block locator. If the number of milestones is greater than 10, subtract 10 from this number and return to step 4. Otherwise return to step 3.

5. Set up a linkage in a new block by inserting the address SMWB of the next vacant block in the 21st word of the current block. Store SMSB as the locator of the next vacant pair of words. Set SMWB equal to the 21st word of this new block. Zero all 21 words of this block.

6. Return to the main program with the next vacant block locator.

F. Summary Output Routine

This program will edit the summary tape tnat was generated by the previous routine and produce a card output tape. From this card output tape, cards can be punched with the format of regular input cards to this PERT program. The SDL and PEN lists will have to be read into core (taking up 2x NOE words) and the summary tape will have to be read in a record at a time. As the information from the summary tape is brought into the core, summary output card images will be formed and written on an output tape (PP1). Titles for events in the summarized network will be included. If event titles are requested the cards without titles will be put on a scratch tape. Then this tape will be merged with the new master file tape to pick up the titles and the results will be written on tape PP1. Only cards with transaction codes 1, 3, 4 or 6 will be produced.

The summary tape consists of 2 word logical records and 250 word physical records. The format of each logical record is as follows:

First word		Second word	
Bits S, 1-11	Not used	Bits S	0 no actual date
12-20	$(SIG)^2$		1 actual date
21-35	BE	1-4	not used
		5-17	t_e
		18-20	not used
		21-35	EE

This routine will produce summary output cards with the following format:

Column	Contents
1	TC
2	SP
3	Scheduled Date Option
4	Blank
5	Blank
6-13	BE
14	BE Level Code
15	Blank
16-23	EE
24	EE Level Code
25-38	a'
29-32	m'
33-36	b'
37-42	Scheduled or Actual Date
43	Blank
44-78	Event Title

The following steps describe the programming sequence:

1. If this is a 12 tape version of the program, set TCKCL to 0, otherwise set TCKCL to a non zero value. Read in the PEN and SDL lists. If TCKCL does not equal zero write the parameter card on tape SXOFL.

2. Read two words from the summary tape into SXS. If an EOF is reached jump to step 13.

3. Fill SXOUT through SXOUT + 7 with blanks. Mask out BE and store (PEN + EE) in SXKC. Compute SIG from the first word (SXS) and then compute 3(SIG). Mask out EE and t_e from the second word. Compute:

   $a = t_e - 3(\mathrm{SIG})$, $m = t_e$, and $b = t_e + 3(\mathrm{SIG})$.

   If a is positive jump to step 4. Otherwise set a to 0 and b to $2t_e$ and go to step 4.

4. If BE is not zero reference (PEN + BE). Unpack this word and store in SXKD and SXKE as 8 digits, a level code and 3 blank BCD characters. If BE is zero continue. Set the transaction code to 1. Store this code in SXOUT bits S-5.

5. If SDL + BE is positive set the short path flag (SP) to blank. Otherwise set SP to 1. Store SP as the second BCD character in SXOUT.

6. If SXKC is zero jump to step 7. Otherwise store the unpacked BE and level code from SXKD and SXKE as the 5th through 13th BCD characters in SXOUT through SXOUT + 2.

7. If the true ending event (PEN + EE) is not zero, unpack this number and level code and store in the EE_i and LC positions of SXOUT + 2 and SXOUT+ 3. Store (PEN + EE) itself in SXOUT - 1. If it is zero jump to step 8.

8. Convert a to BCD and store in A of SXOUT + 4.
   Convert m to BCD and store in M of SXOUT + 4 and
      SXOUT + 5.
   Convert b to BCD and store in B of SXOUT + 5.

9. If bit 2 of (SDL + EE) is 1, store a 1 in 3rd BCD field of SXOUT. Otherwise continue.

10. If bits 23-35 of (SDL + EE) are not zero, a time is given here. Convert this time to a date, put it in the format mo, mo, da, da, yr, yr and store in SXOUT + 6. If these bits are zero continue. Write SXOUT - 1 through SXOUT + 6 onto tape TWSXF.

11. If SXS + 1 is positive jump to step 12. Otherwise change the transaction code in SXOUT bits S-5 to a 4. Convert t_e to an actual date and store in SXOUT + 6. If this is a 16 tape version (TCKCL ≠ 0) write SXOUT through SXOUT + 13 onto SXOFL, the final output tape. If this is a 12 tape version write SXOUT - 1 through SXOUT + 6 onto TWSXF.

12. Reference (SDL + BE). If the predecessor tally (bits 17-22) is not zero, jump to step 2. Otherwise, if the actual date tally (bits 11-16) is zero, set TC to 3. A non zero actual date tally indicates that this beginning event has an actual date. Set TC to 6. Convert the time in bits 23-35 of (SDL + BE) to a date and store in SXOUT + 6. Store the unpacked beginning event in the EE field, SXOUT + 2 and SXOUT + 3. Store blanks in the EE field of SXOUT through SXOUT + 2. Write SXOUT - 1 through SXOUT + 6 onto tape TWSXF. Return to step 2.

13. Rewind the input tape and output tape (TWSXF). If the number of words written onto tape TWSXF is greater than 24,000 (i.e., the number of cards is greater than 3,000) jump to step 16. Otherwise read tape TWSXF into memory and sort on EE internally.

14. If this is a 12 tape version (TCKCL = 0) write the parameter card onto tape SXOFL. Set step 15 to jump to 20 and continue. For both 12 and 16 tape versions merge the data and titles and write on SXOFL.

15. Write 3 cards after the summary cards to indicate the network is complete. Jump to step 21 (or if changed, to step 20).

16. If this is a 12 tape version jump to step 17. Otherwise prepare to sort tape TWSXF with an external sort.

Save the program control parameters. Jump to step 22.

17. Write a copy of the summary network as the second file on the SDL tape.

18. Write the parameter card and the data onto SXOFL.

19. Reposition the SDL tape for the Forward Event List Routine and jump to step 15.

20. Reposition the SDL tape for the Forward Event List Routine.

21. Advance to the Forward Event List Routine.

22. Sort tape TWSXF with an external sort. Merge the data and the titles from TPEN.

23. Read the program control parameters from the 2nd file of the SDL tape into core.

24. Exit to the Forward Event List Routine.

G. Forward Event List Routine

The Forward Event List (FEL) associates an expected time (ET) and a standard deviation (SIG) with each event. These are created by passing once through the ordered activity lists. In addition, a critical predecessor (CP) for each event is determined. The following steps describe the program:

1. Read into core the Scheduled Date List (SDL). Zero another NOE words (up to 12,000) for the Forward Event List (FEL). Set y equal to 1.

2. Set bit 1 of SDL + y to 0. This clears a flag used in the input routine. If the PT field of (SDL + y) does not equal zero, go to step 3. If the PT field of (SDL + y) equals zero (i.e., a beginning event) transmit the scheduled time field of (SDL + y), i.e., bits 23-35 to ET(FEL + y). If the AD field of this same word (SDL + y) is greater than zero set bit 1 of (SDL + y) to 1 and jump to step 4. If AD is not greater than zero, jump to step 4.

3. If the AD field of (SDL + y) is greater or equal to the PT field indicating an event with an actual date, set bit 1 of (SDL + y) to 1, transmit the Scheduled Time field of (SDL + y) 23-35 to ET(FEL + y), and jump to step 4. If the PT field of (SDL + y) is less than the AD field indicating an event without an actual date, go to step 4.

4. If y is greater than NOE jump to step 5. Otherwise replace y and y + 1 and return to step 2.

5. Set x equal to 0, y equal to 1. Read (ACT 1 + 2x) and (ACT 2 + 2x) into a work area.

6. Select BE and EE from (ACT 1 + 2x) and (ACT 2 + 2x) respectively.

7. Transmit (FEL + BE) and (FEL + EE) to a work area.

8a. If bit 7 of ACT 2 equals 0, compute ET(BE) + t_e - ET(EE), set it equal to z and jump to step 9. If bit 7 of ACT 2 equals 1, check bit 1 of (SDL + BE). If this bit is 1, jump to step 8b. If it is zero print out a diagnostic indicating an illegal actual date. Insert 1 in bit 3 of (SDL + BE).

b. Compute TE - ET(EE) and set it equal to z, where TE is the activity actual completion time.

9. If ACT 2 is negative, jump to step 10 (Short Path Flag). If ACT 2 is positive, and z is positive, jump to step 11. If ACT 2 is positive and z is negative, jump to step 13.

10. Short Path Flag -- If ET(EE) is zero, jump to step 11. If not and z is positive jump to step 13. Otherwise jump to step 11.

11. Replace each of the fields in (FEL + EE) as follows: transfer the square root of SIGF(BE)^2 + SIGF(ACT 1)^2 into SIGF(EE) and BE into CP(EE). If bit 7 of ACT 2 equals 1 and ET(FEL + EE) is less than TE, (the activity actual completion time) transmit TE to ET(FEL + EE). At this point check if bit 1 of (SDL + EE) equals 1. If so, transmit TE to bits

23-35 of (SDL + EE) and jump to step 12. If bit 1 is zero, jump to step 12. If bit 7 of ACT 2 equals 1 and ET(FEL + EE) is greater than or equal to TE, jump to step 13. If bit 7 of ACT 2 is 0, transmit ET(FEL + BE) + t_e to ET(FEL + EE) and continue. Check to see if ET(FEL + BE) + t_e exceeds the allowable time. If it exceeds this time, print an error message.

12. If ET(FEL + EE) is greater than LET, replace LET by ET(FEL + EE) and continue. Otherwise continue. Transmit the sign bit of ACT 2 to the sign bit of (SDL + EE).

13. Replace x by x + 1 and y by y + 1. If y is greater than NOA, jump to step 14. Otherwise return to step 5.

14. Write (FEL) through (FEL + NOE + 1) onto tape CK1 as as the first file.

15. Write (SDL) through (SDL + NOE + 1) onto tape UT3 as the first file. Exit.

H. Backward Event List Routine

The Backward Event List (BEL) contains for each event a latest time, LT. This time is similar to the expected time computed for the FEL except that the ordered network is processed from its ending events backward to its starting events. At this time the SDL is in the core. The first step is to put the latest time into the BEL for all events and to change these as we process through the Activity List.

1. If NCD (Network Completion Date) does not equal zero, jump to step 2. Otherwise transmit LET to NCD.

2. Reserve NOE words for the BEL list. Add 17777_8 into the LET field of each word on the BEL list.

3. Set x equal to 1.

4. Reference the ST field of (SDL + x). If ST does not equal zero, jump to step 5. Otherwise, if the SD field of (SDL + x) equals zero (i.e., the end event

of the system does not have a scheduled date) mask NCD into LT field of (BEL + x) and jump to step 7. If not, mask the SD field of (SDL + x) into the LT field of (BEL + x) and jump to step 7.

5. The event x is not an end event of the network. Reference bit 2 of (SDL + x). If it is 0, jump to step 6. If bit 2 of (SDL + x) equals 1, check to see if the SD field of (SDL + x) equals zero. If so, jump to step 7. Otherwise mask the SD field of (SDL + x) into the LT field of (BEL + x) and jump to step 7.

6. If bit 1 of (SDL + x) equals 1, transmit bits 23-35 (SDL + x) to the LT field of (BEL + x) and continue. Otherwise continue.

7. If x is greater than NOE go to step 8. Otherwise add 1 to x and return to step 3.

8. Set y equal to 1.

9. Read the next ACT 1 and ACT 2 words from the Backward Activity Tape into a work area. Select BE and EE from ACT 1 and ACT 2 respectively.

10. With BE and EE from ACT 1 and ACT 2 transmit (BEL + BE) and (BEL + EE) to a work area. If bit 1 of ACT 2 equals 1, set bit 9 of (BEL + BE) to 1. If bit 2 of ACT 2 equals 1, set bit 9 of (BEL + EE) to 1.

11. If bit 7 of ACT 2 equals 1, jump to step 13.

12. Compute LT(BE) - (LT(EE) - t_e) equals z. The sign of LT is given in bit 21 of FEL. Consider the sign of LT in computing z. If z is negative go to step 13. Otherwise, transfer (LT(EE) - t_e) into LT(BEL + BE), store the sign of (LT(EE) - t_e) in bit 21 of (BEL + BE) and store the square root of SIGB(EE)^2 + SIGB(ACT 1)^2 in SIGB(BE).

13. Replace y and y + 1. If y equals NOA exit. Otherwise return to step 9.

I. Event Assembly Routine

This routine will gather all the information concerning each event and will produce the event assembly tape. Depending upon the information requested this tape may contain as many as three groups. One group may be ordered by event number, one by expected time, and one by slack. This tape will contain the following 14 words of information for each event (one logical record).

1. 9PAC control character
2. Information to be sorted by 90 SORT (PEN, ET, or SLACK) or blank if NOE is less than or equal to 2000
3. Packed event number from PEN list
4. Packed critical predecessor from PEN list
5. Scheduled Date List word for the event
6. Forward Event List word for the event
7. Backward Event List word for the event
8. Event Slack

9-14. Title for the event

The first physical record on the tape will have network information as follows:

1. 010000000000 (9 PAC Control Character)
2. NOE
3. NOA

4-14. Parameter Card (Columns 1-66)

15. 010000000000 (9 PAC Control Character)

16-18. Parameter Card (Columns 67-80)

19-28. Not used.

This routine is divided into two main sections. Section 1 is used when the number of events is less than 2000. In this section information is taken from PEN, FEL, BEL and SDL. The resulting records of information are sorted internally and merged with the event title tape. Additional sorts are made if expected time and slack listings were requested. The output is written on the event assembly tape.

Section 2 is used when there are 2000 or more events. Information is taken from the same 4 lists but is written immediately on a scratch tape UT3. UT3 is then sorted by IB90 SORT by the PEN number words (the packed true event numbers). Then tape UT3 is merged with the event title tape. This entire set of merged records is written on tape L1, one, two or three times depending on the number of distinct event reports requested (event number/event expected time/ event slack). Each set of records has distinct control words for sorting. The first word distinguishes the set (2, 3 or 4) and the second word controls the sorting within the set (set 2 is sorted by the event number, set 3 by event expected time, and set 4 by slack). Tape L1 is now sorted by IB90 SORT and the result is made available to the edit routine.

The following steps describe the programming sequence:

1. If column 21 of the initial parameter card is blank, write a comment on the printer and the output tape that no event output was requested and continue. Otherwise, go to step 3.

2. Position the input tape past the 90 SORT control cards for event data SORT, the binary event assembly program, and the 90 SORT control cards for event report sorting since they will not be used. Exit from routine.

3. If NOE is greater than 2000, jump to step 23. Otherwise continue. Let EAL (Event Assembly List) be an area of 6 x NOE words (up to 12,000). Let EAL2 be equal to EAL + 12,000. Read PEN from the PEN tape into every 6th word of EAL2 beginning with EAL2 + 0. Read FEL from the FEL tape into every 6th word of EAL2 beginning with EAL2 + 3.

4. Set x equal to 1, y equal to (EAL2 + 1). Start reading SDL and BEL into the IOCS buffers. Reference CP, the critical predecessor pseudo event number, from (y + 2). Transfer (EAL2 + 6 x CP - 6) to (y).

5. Transfer the xth word of SDL from the IOCS buffer to (y + 1). Transfer the xth word of BEL from the IOCS buffer to (y + 3). If bit 1 of (y + 1) equals 1, transmit -37777 to (y + 4). This will put this record first on an ordering by slack. Jump to step 6. If bit 1 of (y + 1) equals 0, reference bit 3 of SDL. If it equals 1, the event should have had an actual time. Transmit +37777 to (y + 4) and jump to step 6. This will put this record last on a slack listing. If bit 3 equals 0, continue. Compute slack as LT - ET and store in (y + 4).

6. If x equals NOE go to step 7. Otherwise add 1 to x and 6 to y and return to step 5.

7. Sort EAL2 (6 word record) by event number (bits S-31 of the first word).

8. Initiate reading of the Event Nomenclature (Title) Tape (7 word logical record) into the IOCS buffers.

9. Set x equal to 0.

10. Transfer 7 words to a temporary storage area (EBIN through EBIN + 6). If an EOF is reached on ENOM tape transfer all 1 bits to (EBIN).

11. Transfer 6 words beginning with (EAL2 + 6x) to (EAL + 12x).

12. If bits S-31 of (EAL2 + 6x) equal bits S-31 of (EBIN) go to step 13. If bits S-31 of (EAL2 + 6x) are less than bits S-31 of (EBIN) go to step 15. If bits S-31 of (EAL2 + 6x) are greater than bits S-31 of (EBIN) go to step 16.

13. Transfer (EBIN + 1) through (EBIN + 6) to (EAL + 6 + 12x) through (EAL + 11 + 12x).

14. Increase x by 1. If x is not equal to NOE go to

step 10, otherwise jump to step 17.

15. Transfer blanks to (EAL + 6 + 12x) through (EAL + 11 + 12x). Increase x by 1. If x is not equal to NOE, go to step 11, otherwise go to step 17.

16. Transfer the message NOMENCLATURE TAPE ERROR bb--b to(EAL + 6 + 12x) through (EAL + 11 + 12x). Go to step 14.

17. Write the initial 28-word record on the Event Assembly Tape (EALT). Check bit 1 of column 21 of the initial parameter card. If it equals 1 add the 02 9PAC control character and a word of blanks to each logical record and write the 14 word logical record on the Event Assembly Tape.

18. If the second bit in column 21 of the initial card equals 1, go to step 19; otherwise go to step 20.

19. Sort EAL (12 word records) by expected time (bits 23-35 of the 4th word). Add the 03 9PAC control character, a word of blanks and write the 14 word logical record on the Event Assembly Tape.

20. If the 3rd bit in column 21 of the initial parameter card equals 1, go to step 21, otherwise go to step 22.

21. Sort EAL (12 word records) by slack. Add the 04 9PAC control character, a word of blanks, and write the 14 logical records onto the Event Assembly Tape.

22. Write EOF on the EALT and rewind. Go to step 2.

23. In order to develop the Event Assembly Tape for networks of more than 2000 events, the IB 90 SORT System must be used. The final result will be on the EALT. identical to the one generated in steps 3 through 22. Read the PEN list into EAL. Read the FEL list into EAL2.

24. Start reading BEL and SDL into IOCS buffers.

25. Set x = 1; reserve (EBIN) through (EBIN + 5) for the event output record.

26. Transmit (FEL + x) to (EBIN + 3). Reference CP from (EBIN + 3). Send (PEN - 2 + CP) to (EBIN + 1). Transmit (PEN + x) to (EBIN). Transmit (SDL + x) to (EBIN + 2). Transmit (BEL + x) to (EBIN + 4).

27. If bit 1 of (EBIN +2) equals 1, transmit -37777 to (EBIN + 5). This will put this record first on a slack sort. Jump to step 28. If bit 1 of (EBIN +2) equals 0, continue. Reference bit 3 of (EBIN +2). If this bit equals 1, the event should have had an actual time. Transmit +37777 to (EBIN + 5) and jump to step 28. This will put this record last on a sort listing. If this bit equals zero, continue. Reference LT and compute slack = LT - ET. Store in (EBIN + 5).

28. Transmit (EBIN) through (EBIN + 5) as record number x for output on a scratch tape (EAENF).

29. If x = NOE jump to step 30. Otherwise, add 1 to x and return to step 26.

30. Save needed core memory by writing it as the second file of SDL and exit to 90 SORT. Sort event assembly list (6 word records on tape) by bits S-31 of the first word of each record.

31. Bring memory back in from the 2nd file of SDL tape. Prepare to merge the event information and event title. Start reading information into IOCS buffers. If column 21 of the parameter card contains only a 1, write output on the EALT tape. If column 21 contains any other combination of bits, write output onto a scratch tape to be sorted by 90 SORT. When writing records put the appropriate 9PAC character (020000000000, 030000000000, 040000000000) in word one and the information to be sorted in word two of the 14 word logical record. Set x = 1. Write the initial 28 word record onto the output tape (Scratch or EALT).

32. Transfer seven words from NOMEN buffers to (EAL2) through (EAL2 + 6).

Logical Records are 14 words

The First Physical Record Equals Two Logical Records
Successive Physical Records Equal 17 Logical Records

FIRST & SECOND LOGICAL RECORDS								SUCCESSIVE LOGICAL RECORDS						
Foot-note	Contents						Word No.	Foot note	Contents					
1	01	00	00	00	00	00	1	10	Ox	00	00	00	00	00
2				NOE			2	11	Sort Control Word					
3				NOA			3		Event Number					LC
4	Da.	Da.	Mo.	Mo.	Mo.	Yr.	4		Critical Predecessor					LC
5	Yr.	RN	RN	CK		MP	5	12	SDL word					
6	Mo.	Mo.	Da.	Da.	Yr.	Yr.	6	12	FEL word					
7	EL	SM	ER		CC		7	12	BEL word					
8	Mo.	Mo.	Da.	Da.	Yr.	Yr.	8		±			Event Slack		
	System Number						9		Event Title			(ET)		
	Output Title (OT) ...						10		ET					
	OT						11		ET					
	OT						12		ET					
	OT						13		ET					
	OT						14		ET					
	01	00	00	00	00	00	1							
	OT						2							
	User's Title						3							
9		AO					4							
	blanks						5-14							

1. This word is a SORT control word.
2. NOE-number of events (octal.).
3. NOA-number of activities (octal.).
4. Report date.
5. RN-run number, CK-checkout flag, MF-master file indicator.
6. Start date.
7. EL-E-L chart report indicator, SM-summary report indicator, ER-event report indicator, CC-clock indicator.
8. End date.
9. AO-activity output indicator.
10. x = 2, 3, or 4 indicates that data is to be sorted by event number, event expected time or event slack respectively.
11. If x = 2, 3, or 4, this word contains the event number, the event expected time or the event slack.
12. The SDL, FEL and BEL words corresponding to this event.

Figure II-2
Event Assembly Tape Format (Binary Tape)

33. Transfer six words from sorted event number information to EAL through (EAL + 5). Move this to (EATOB + 2) through (EATOB + 7).

34. If EAL bits S-31 equals EAL2 bits S-31 go to step 35. If EAL bits S-31 is less than EAL2 bits S-31 go to step 37. If EAL bits S-31 is greater than EAL2 bits S-31 go to step 39.

35. Transfer the six words beginning with (EAL2 +1) to the output buffer (EATOB + 8) through (EATOE + 13). Move in appropriate 9PAC control character, and 90 SORT information and write a record onto the tape.

36. If x = NOE jump to step 40; otherwise, increase x by 1, and return to step 32.

37. Transfer six words of blanks to the output buffer (EATOB + 8) through (EATOB + 13). Move in appropriate 9PAC control character and 90 SORT information and write record or records onto output tape.

38. If x = NOE jump to step 40; otherwise, increase x by 1 and return to step 33.

39. Transfer six words with the message NOMENCLATURE TAPE ERROR b--b to the output buffers (EATOB + 8) through (EATOB + 13). Move in appropriate 9PAC control character and 90 SORT information and write a record onto the output tape.

40. If the 2nd and 3rd bits of column 21 are both zero, position the input tape past the 90 SORT control cards since the second 90 SORT will not be needed. Exit. Otherwise, exit to the 90 SORT routine which will sort the event assembly tape on words 1 and 2.

J. <u>Event Output Routine</u>

This routine edits the Event Assembly List Tape (EALT) and produces an event output for printing. The EALT contains 2 initial 14 word records with information concerning the entire network. Following it will be a 14 word record for each event. These events will be properly ordered for each of the 3 possible sequences that are requested.

The first word of each record indicates the sequence (2 = event number, 3 = expected time, and 4 = slack). The first NOE event records (after the initial record) will all have the same number in the first word. If a second ordering was requested, another NOE event record will follow with a second number found in each record's first word, etc.

The following describes the development of the heading for each page and the editing of the information for each event. All information for a printed line of output for each event can be obtained from an event record as follows. The placement of this information on the output sheet can be seen from the Event Output Sample.

1. The Event Title consists of 35 characters in words 9-14 of the event record. It is to be printed out in positions 2-37 of the line of output.

2. If bit 9 of BEL is a "1" (this indicates an interface event) print an I immediately before the event number. The event number packed 4 bits per digit is found in bits S-31 of the 3rd word. These 8 digits must be unpacked, dashes inserted, and stored in the output buffer. The level code for this event is found by referencing bits 32-35 of the 3rd word. Since the level code is most frequently blank, check to see if bits 32-35 are 1111. Otherwise, convert the level code as follows: 0000, Level Code = A; 0001, LC = B, etc. through O.

3. The critical predecessor of the event number is found in the 4th word with its level code. Prepare it for output following the same steps as described in step 2.

4. If the SDL word (the 5th word) is negative, this indicates that the short path flag option has been chosen with this event. Print out an S in the SP column. If the 5th word is positive, leave SP blank.

5. Next up to 4 dates are to be printed out. Each of these dates is given in the record as a time and must run thru the time to date routine. First check bit 1 of the 5th word (SDL). If it is a zero, no actual date is given. Put blanks in the Actual Date field and jump to step 6. Otherwise, mask out bits 23-35

from the 6th word (FEL). This field is the actual time and event expected time for the event. Convert this time to a date and send it to the actual date field in the output buffer. Put blanks in the latest date and expected date field and jump to step 8.

6. Mask out bits 23-35 of the 6th word, convert this time to a date and send it to the Expected Date field.

7. Mask out bits 21-35 of the 7th word. This time is the Latest Time. This time can be negative. Its sign is bit 21. Convert it to a date and send it to the latest date field in the output buffer.

8. Mask out bits 23-35 of the 5th word. If they are zero, no scheduled time is given. Put blanks in the scheduled date field and jump to step 11. If they are not zero, check the PT field (bits 17-22) of the same word. If PT does not equal zero, the time is a scheduled time. Jump to step 9. Otherwise, if AT (bits 11-16) equals zero, jump to step 9. If AT does not equal zero, the time in bits 23-35 is a beginning event actual time and is not to be printed out here. Put blanks in the scheduled date field and jump to step 10.

9. Convert the scheduled time to a scheduled date and send to the output buffer. If bit 2 of the 5th word equals 1 insert an asterisk before the date.

10. The probability of meeting the scheduled date must be computed when a scheduled date is given. Step 9 will have been executed only when a scheduled date was given, hence it will not be necessary to check for the existence of a scheduled date again. Compute ST (scheduled time from bits 23-35 of the 5th word) -ET (expected time from bits 23-35 of the 6th word) = X. X is an integer representing the difference in tenths of weeks between the expected and scheduled time. Divide X by SIGF, the standard deviation forward from bits S1-8 of the 6th word. SIGF is a 9 bit unsigned integer. Let X/SIGF=Z. Round off to 3 bits to the right of the binary point.

b. If the Z is greater than +2.78 set the probability equal to 1.00, if Z is less than -2.78 set the probability equal to 0.000, and if Z equals 0 set the probability equal to 0.50. Otherwise take the integral part of the absolute value of 10 times Z and reference a Normal Curve Area List (NCAL). The contents of (NCAL + 10Z) contains the area under the Normal Curve from its center to Z standard deviations (based on a normalized table). To compute this area, and in turn the probability, the program selects one of the following two alternatives.

If Z is positive, the probability equals (NCAL + 10Z) + $.5_{10}$ and if Z is negative, the probability equals $.5_{10}$ - (NCAL + 10Z). Send this probability to the output buffer.

11. The slack value associated with each event is found in the 8th word. It has been computed by the Event Assembly Routine as an algebraic integer (plus or minus) in tenths of weeks. To print out this time in weeks, accurate to one-tenth of a week, compute the equivalent decimal integer from the binary integer and insert a decimal point preceding the right-most digit. Before converting this slack for output test to see if the value is -37777. If so print blanks for the slack. If the slack number is +37777, print "Error" in the slack field; and insert blanks in the latest date, scheduled date, probability, and standard deviation fields; and jump to step 14. Otherwise convert and print out a value for slack.

12. The Standard Deviation for each event is found in bits S, 1-8 of the 6th word. It is always a positive integer so all 9 bits refer to the value of the number. It represents a standard deviation in tenths of weeks. The conversion for printing out is like the one for the slack value. Convert this integer into its decimal equivalent and print it out with a decimal point before the right-most digit. Although 3 digits to the left of the decimal place have been reserved in the format, the maximum value that will ever occur is 51.1.

13. The probability of positive slack is computed in a fashion similar to the probability in step 10. Compute X = LT (latest time from bits 23-35 of the 7th word) - ET (expected time from bits 23-35 of the 6th

word). Convert LT to an algebraic number by examining bit 22 and, if it is a 1, make LT negative before computing y. Next compute SIG equal to the square root of $(SIGF)^2 + (SIGB)^2$. Do this by squaring the 9 bit numbers in bits S, 1-8 of the 6th and 7th words, taking the square root of the sum of these and retaining 9 bits. Compute Z equal to -y/SIG. Round off to 3 bits to the right of the binary point. Execute the steps described in 10b, sending the result to the output buffer in the probability of positive slack field.

14. Write this output buffer on tape for printing, read in another event assembly record and return to step 1.

K. E-L Chart Routine (By Weeks)

The E-L Chart is a chronological display of the Expected Date, Latest Date and, when given, the Scheduled and Actual Dates of each event. The display starts with the report date, which must be equal or later than the start date, and prints out results in weekly increments from this date. The total time interval that will be displayed is a little longer than 1.5 years.

Events with actual dates before the report date will not be listed. Events with expected dates before the report date will be listed but without any indication on the chart. Events with expected dates falling within the time span of the chart will be listed together with their respective graphical display. Finally those events whose expected time is later than can be shown on the chart will not be listed.

The following steps describe the programming sequence:

1. Set an event counter to zero. Locate the report date and convert it to a time. Compute the chart's limit CL = report time + 85 weeks. Locate the expected time ordering on the Event Assembly Tape.

2. Print out the same heading as is printed with an event output. Indicate that this is an E-L chart. Set a line counter to 0.

3. Print out 3 more lines of heading as follows:

On the first line beginning in column 60, print WEEKS FROM REPORT DATE.

On the second line beginning in column 2, print EVENT NUMBER SLACK; beginning in column 48 print the report date; and in columns 57, 67, 77. ..., 127 print the numbers 1, 2, 3, ..., 8.

On the third line beginning in column 2, print TITLE; and beginning in column 48 print 1234567890-123456789012 ... thru column 132.

4a. Fill a print buffer (132 characters) with blanks with the exception of columns 52, 57, 62, 67. ..., 132. Fill these positions with periods.

b. Add 1 to the event counter. If the event counter is greater than NOE, exit. Otherwise read in an Event Assembly Record. If the event expected time is greater than or equal to the report time, go to step 7. Otherwise if the event has an actual date, return to 4b. If the event has no actual date, print out on the next line the event number and level code as xx-xxx-xxx x. Compute the event slack (latest time minus expected time) and print this signed number as ±xxx.x in columns 16-21. Convert the expected time to a date (in this case the date is earlier than the report date) and print as DDMMMYY in columns 39-45. Advance the line counter by 1.

5. Print out the event title in columns 1-36 and the event latest date (calculated from the latest time) in columns 39-45. Advance the line counter by 1. If the event does not have a scheduled time go to step 6. Otherwise, print SCHEDULED DATE in columns 24-37 and convert the scheduled time to a date and print it in columns 39-45. Advance the line counter by 1.

6. If the line counter is greater than 48, go to step 2. Otherwise, return to step 4.

7. If the expected time is greater than the chart's limit CL, exit from program. Otherwise if the event does not have an Actual Date, jump to step 9. Otherwise continue.

8. Print out on one line the event number in columns 2-14. Print ACTUAL DATE in columns 27-37 and print the actual date itself in columns 39-45. Advance the line counter by one and return to step 6.

9. Print out the event number in columns 2-14. Convert the expected time to a date and print the date in columns 39-45. Compute the event slack (latest time minus expected time) and print this signed number as ±xxx.x in columns 16-21. Subtract the report time from the expected time and divide this resulting integer (in tenths of weeks) by 10_{10}. Take the quotient (q), an integer between 0 and 84, and print an E in column 48 + q. If column 19 of the initial parameter card is a "2", jump to step 10, and omit the computation of the D's on this chart. Otherwise continue. Compute three times the event standard deviation (3d), rounded to weeks. If 3d is less than 1 week, jump to step 10. Otherwise print a D in column 48+q+3d and a D in column 48+q-3d, provided these numbers are within the chart limits. Add one to the line counter.

10. Check to see if there is an event title and, if so, print it out. Convert the latest time to a date and print the date in columns 39-45. Add 1 to the line counter. Subtract the report time from the latest time and if the result is not within the chart limits, go to step 11. Otherwise divide this result by 10_{10}, take the quotient (q) and print an L in column 48+q.

11. If the scheduled time is not given, jump to step 6. Otherwise convert the scheduled time to a date and print the date in columns 39-45. Add 1 to the line counter. Subtract the report time from the scheduled time and if the result is not within the chart limits go to step 6. Otherwise, divide this result by 10_{10}, take the quotient (q) and print an S in column 48+q. Return to step 6.

L. E-L Chart Routine (By Months)

The E-L Month Chart is a chronological display of the Expected Date, Latest Date and, when given, the Scheduled and Actual Dates of each event by months. This display will start with the month in which the Report Date is located and include the following 84 months. The Report Date must be equal to or later than the Start Date.

Events with actual dates before the report date will not be listed. Events with expected dates before the report date will be listed but without any indication on the chart. Events with expected dates falling within the time span of the chart will be listed with their dates in proper position on the chart (i.e., under the month in which the date occurs). Finally, those events whose expected time is later than can be shown on the chart will not be listed.

The following steps describe the programming sequence:

1. Locate the report date and convert it to a time. Locate the expected time ordering on the Event Assembly Tape. When this list has been exhausted, exit from this program.

2. Print the same heading as is printed with an event "EDATE" output, except the designation "E-L MONTH CHART" has been included in the first line of the heading.

3. Print out 3 more lines as follows:

   On the first line beginning in column 47 print the report date in the form DDMMMYY; skip 19 columns and print THE REPORT DATE AND FOLLOWING 84 MONTHS.

   On the second line beginning in column 2 print EVENT NUMBER, skip 3 columns, print SLACK, skip 17 columns, print DATE, skip 5 columns, print an asterisk and print the year numbers in sequence from the report date year over the January and February positions on the chart.

   On the third line beginning in column 2 print TITLE, skip 41 columns and print the first letter of each month in succession beginning with the month of the report date and cycling through a total of 84 months.

4a. Fill the print bin with blanks with the exception of columns 52, 57, 62, 67, ..., 132. Place a period in these columns to facilitate reading the chart.

b. Read in an Event Assembly Record. If the first word of this record is not 030000000000, exit from this routine since all records have been processed. If the expected time is greater than the report time, go to step 7b; if less, continue. Check for an actual date. If there is an actual date, return to 4b (thus omitting all completed events prior to the report date). If there isn't an actual date prepare to print one line. In column 2, print the event number and level code, in columns 16-21 print the slack (this has been computed and is located in the eighth word of the Event Assembly Record), in columns 39-45 print the expected date computed from expected time. Advance the line counter by 1. Fill the print bin as in step 4a.

5. Print the event title in columns 1-36 and the event latest date (computed from the latest time) in columns 39-45. Advance the line counter by 1. If the event does not have a scheduled date, go to step 6. Otherwise fill the print bin with blanks and dots as in step 4a and print SCHEDULED DATE in columns 24-37. Convert the scheduled time to a date and print in columns 39-45. Advance the line counter by 1.

6. If the line counter is greater than 48, go to step 2; otherwise go to step 4a.

7a. Convert the expected time to a date. Compute the time in months from the report date to the expected date. If this time interval exceeds the chart's limit (84 months) exit from this routine. Store this number of months in MWK3 and go to step 7c.

b. Convert the expected time to a date. Since the expected date and report date are the same, store zero in MWK3.

c. If the event has an actual date, go to step 8; if no actual date, go to step 9.

8. Print the event number and level code in columns 1-14. Print ACTUAL DATE in columns 27-37 and print the actual date itself in columns 39-45. Advance the line counter by 1 and go to step 6.

9. Print the event number and level code in columns 2-13 (xx-xxx-xxx x). Print the slack in columns 39-45. Print "E" for the expected date in column 48 + MWK3. Advance the line counter by 1 and fill the print bin as in step 4a.

10. Print the title for this event in columns 1-36. Convert the latest time to a date and print in columns 39-45. Compute the time in months from the report date to the latest date. Print "L" in column 48 plus the above number of months. Advance the line counter by 1.

11. Check for a scheduled date. If none go to step 6. Otherwise, compute the time from the report date to the scheduled date in months. Fill the print bin as in step 4a. Print "S" in column 48 plus the above number of months. Print the scheduled date in columns 39-45 and go to step 6.

M. Activity Assembly Routine

This routine gathers all the information concerning each activity and writes it as a record on an Activity Assembly Tape (AAT). The first record on the AAT will have general information about the network to be used in developing the page headings in the output. Then there will be from one to three records for each activity, depending on how many different orderings of the activity output are requested. These will be identical except for the first two words of each record, which will contain information pertaining to each particular order requested.

The format of the first record and successive records is shown at the end of this section. The following steps describe the programming sequence:

1. Advance the new master file tape one file. Read in the next record from this tape. Make up the first record for the activity assembly tape as shown in the activity assembly tape format. Write it on a scratch tape (to be used in step 3). NOE and NOA are at locations NOE and NOA in the memory. Words 11-24 are just a copy of the initial input card and are found in the record just read from the master file tape.

2. To generate the AAT information the PEN, SDL, FEL, and BEL lists must be available together with the ACT 1 and ACT 2 words and also the activity input data from the new master file tape. If NOE is less than or equal to 6000 go to step 3. Otherwise jump to step 8.

3. Read the PEN, SDL, FEL, and BEL lists into the core (4 times NOE words). Set up the input and output buffer areas. Prepare to write the output on a scratch tape (not the Activity Assembly Tape, AAT) at this time.

4. Read the ACT 1 and ACT 2 words in the input buffer area. Read the next record from master file into input buffer area.

5. Transfer the ACT 1 and ACT 2 words to a 2 word work area. If an end-of-file is reached jump to 17; otherwise get BE and EE from ACT 1 and ACT 2.

6a. Assemble the 24 word activity record for the AAT as follows:

Word Number	
1-2	Blank
3-9	Words 1-7 of the master file record
10	Reference CP from (FEL+EE). Word 10 is (PEN+CP).
11	(FEL + BE)
12	(BEL + EE)
13	(SDL + EE)
14-15	Locate, compute, and store the following items in these two words. Mask

out the activity actual date flag from bit 7 of ACT 2 and store in bit "S" of word 14. From ACT 1 and ACT 2 locate t_e and sigma and store in bits S-12 and 13-20 of word 15. Compute AET, the activity expected end time as follows. If bit 7 of ACT 2 equals 0, AET equals ET(FEL + BE) + t_e. Store AET in bits 21-35 of word 15. Compute the activity slack equals LT(BEL + EE) - AET and store it in bits 22-35 with the sign of the result in bit 21 of the 14th word. Jump to step 6b.
If bit 7 of ACT 2 equals 1, AET equals t_e. Store AET as above and store -37777 for the activity slack.

b. Compute the event slack as follows: If bit 1 of SDL + EE equals 1, store -37777 for the event slack. Jump to step 6c. If bit 1 of SDL + EE equals 0, check bit 3 of SDL + EE. If it equals 1 the event should have had an actual time. Store +37777 for the event slack and jump to step 6c. If bit 3 equals zero continue. Compute event slack equals LT(BEL + EE) - ET(FEL + EE) and store it in bits 7-20 with the sign of the result in bit 6 of the 14th word.

c. 16-18 Transfer activity associated information from words 16-18 of the master file record into words 16-18 of the activity record.

19-24 Transfer the activity title from words 19-24 of the master file record into words 19-24 of the activity record.

7a. If an ordering by activity number is not requested, jump to step 7b. If an ordering by activity number is requested (check the initial input card) put "2" in bits 3-5 of word 1 and the packed ending event number (without the LC) in bits 4-35 of word 2. Send this 24 word record to the output buffer area. If NOA is greater than 1000 continue. Otherwise jump to step 4.

b. If an ordering by expected time is not requested, go to 7c. If an ordering by expected time is requested put "3" in bits 3-5 of word 1 and AET (Activity Expected Time as computed above) in the second word. Send this 24 word record to the output buffer area. If NOA is greater than 1000 continue. Otherwise jump to step 4.

c. If an ordering by activity slack is not requested, jump to step 4. Otherwise put a "4" in bits 3-5 of the first word and the activity slack in bits 22-35 of the second word, with its sign in bit S of the second word. Bits 1-21 should be zero. Send this 24 word record to the output buffer area and return to step 4.

8. Read the SDL and BEL lists into the core (2 times NOE words). Set up input and output buffer areas. Prepare to write the output on a scratch tape (use AAT if needed).

9. Read ACT 1 and ACT 2 list of words into buffer area.

10. Transfer the ACT 1 and ACT 2 words to a 2 word work area. If an end-of-file is reached, jump to step 12. From ACT 1 and ACT 2 mask out EE.

11. Assemble the following 4 words: ACT 1, ACT 2, (BEL + EE), and (SDL + EE). Send them to the output buffer area to be written out on a temporary tape as 4 word records. Return to step 10.

12. Rewind the above temporary tape. Read PEN and FEL into core. Set up the input and output buffer area. Prepare to write the output on a scratch tape (same tape used in step 3).

13. Read the 4 word records into the input buffer area. Read the next record from thc master file into the input buffer area.

14. Transfer ACT 1, ACT 2, BEL + EE, and SDL + EE to 4 word work area. If an end-of-file is reached jump to step 17. Otherwise get BE from ACT 1.

15. Assemble the 24 word activity record for the AAT as described in step 6.

16. Write 1, 2, or 3 records from the output buffer areas on the scratch tape as described in step 7.

17. Rewind the scratch tape.

18. The scratch tape must now be sorted. If NOA is less than or equal to 1000, jump to step 19. Otherwise set up the parameters to sort x times (NOA) + 1 records (x=1,2, or 3 depending on the number of sorts requested) and write the sorted results on the AAT. The control fields for this sort are bits 3-5 of word 1 and S-35 of word 2. Word 2 should be sorted algebraically. Exit.

19. For 1000 or less activities internal sorts can be made. Read in NOA + 1 records (to include the first record). Send the first record to an output buffer to be written on the AAT.

20. Check for the first word of the 2nd record. If it has a "2" in bits 3-5 jump to step 21. If it has a "3" in bits 3-5 jump to step 23. If it has a "4" in bits 3-5 jump to step 25.

21. Send this list out to the AAT tape thru the output buffers since it is already sorted by EE.

22. Check to see if a sort by expected time was requested. If not, jump to step 24. Otherwise put "3" in bits 3-5 of word 1 of each record and, for each record, transfer the activity expected time from bits 21-35 of the 15th word to the same position in the second word.

23. Sort the NOA 24 word records by bits 21-35 of the second word and write this list on the AAT via the output buffer.

Logical Records are 24 words Physical Records are 10 Logical Records

FIRST RECORD (Initial Information)								SUCCESSIVE RECORDS 1 to 3 Records for Each Activity						
Footnote	Contents						Word No.	Footnote	Contents					
1	01	00	00	00	00	00	1	1,14	0x	00	00	00	00	00
1	00	00	00	00	00	00	2	1,15	Sort Control Word					
2				NOE			3	16	TC	SP	SO		BI	BE$_1$
3				NOA			4	17	BE$_2$	BE$_3$	BE$_4$	BE$_5$	BE$_6$	BE$_7$
4				Base Time			5	18	BE$_8$	LC	EI	EE$_1$	EE$_2$	EE$_3$
5				NCD			6	19	EE$_4$	EE$_5$	EE$_6$	EE$_7$	EE$_8$	LC
	Not used						7	20	a	...		a	m	...
	Not used						8			m	b	...		b
	Not used						9	21	Mo.	Mo.	Da.	Da.	Yr.	Yr.
	Not used						10	22	Critical		Predecessor			
6	Da.	Da.	Mo.	Mo.	Mo.	Yr.	11	23	FEL word					
7	Yr.	RN	RN	CK		MF	12	24	BEL word					
8	Mo.	Mo.	Da.	Da.	Yr.	Yr.	13	25	SDL word					
9	EL	SM	ER		CC		14	26	x	±Evnt Slk		±Act Slack		
10	Mo.	Mo.	Da.	Da.	Yr.	Yr.	15	27	t$_e$		sig	AET		
11	SN	...					16	28	AF$_1$	AF$_1$	AF$_1$	AF$_1$	AF$_2$	AF$_2$
	Output Title (OT) ...						17		AF$_2$	AF$_2$	AF$_3$	AF$_3$	AF$_3$	AF$_3$
	OT						18		AF$_4$	AF$_4$	AF$_4$	AF$_4$	AF$_4$	AF$_4$
	OT						19		Activity Title (AT)					
	OT						20		AT	...				
	OT						21		AT	...				
	OT						22		AT	...				
12	UI						23		AT	...				
13		AO					24		AT	...				AT

1. This word is a SORT control word.
2. NOE-number of events (octal.).
3. NOA-number of activities (octal.).
4. Base time-the time from 1 January 1945 to the network's start date (octal.).
5. NCD-network completion time (octal.).
6. Report date.
7. RN-run number, CK-checkout flag, MF-master file report indicator.
8. Start date.
9. EL-E-L chart report indicator, SM-summary report indicator, ER-event report indicator, CC-clock indicator.
10. End date.
11. SN-system number.
12. UI-users symbol or name.
13. AO-activity output indicator.
14. x = 2, 3 or 4 indicates that data is to be sorted by EE-BE, expected time or activity slack respectively.
15. If x = 2, 3 or 4 this word contains a beginning event number, an expected time or an activity slack path respectively.
16. TC-transaction code, SP-short path flag, SO-scheduled date option, and BI-interface code for BE.
17. BE$_i$-ith digit of the beginning event number.
18. LC-level code, EI-ending event interface code.
19. EE$_i$-ith digit of the ending event number.
20. a-optimistic time, m-most likely time, b-pessimistic time.
21. Scheduled date.
22. A 32 bit event number plus a 4 bit level code.
23. FEL word for EE.
24. BEL word for EE.
25. SDL word for EE.
26. x (Sign bit)-activity actual date flag.
27. t$_e$- activity expected time, sig-activity standard deviation, AET-activity expected end time.
28. AF$_i$-a character of the ith word of the activity associated information.

Figure II-3
Activity Assembly Tape Format (Binary Tape)

24. Check to see of a sort by slack was requested. If not, jump to step 29. Otherwise put a "4" in bits 3-5 of the first word of each record and the activity slack (from 21-35 of the 14th word) into bits 22-35 of the second word with its sign in bit S of the second word. Bits 1-21 should be zero.

25. Prepare the sort algebraically by slack. Test the sign of the second word. If negative complement this entire word (except the sign) and continue. Otherwise continue. Change the sign of the second word.

26. Sort the NOA records by bits S, 22-35 of the second word.

27. After sorting change the slack value to its original form as follows:

    If the second word is positive, complement the word except the sign, and continue. Otherwise continue. Change the sign on the second word.

28. Write the sorted list out on the AAT.

29. Exit.

N. Activity Output Routine

This routine edits the Activity Assembly Tape (AAT) and produces an Activity Output for printing. The AAT contains an initial 24 word record with information concerning the entire network. Following it is a 24 word record for each activity. These records are properly ordered for each of the 3 possible orderings that are requested. The first word of each record indicates the ordering (2 = activity number, 3 = activity expected time and 4 = slack). The first NOA activity records (after the initial record) all have the same number in the first word. If the second ordering is requested, another NOA activity record follows with a second number found in each record's first word, etc. The heading for each page is identical to the event output heading described above with the title Activity Report.

The following describes the editing of the information for each activity. From each record all information for two lines of output can be obtained as follows. The placement of this information on the output sheet can be seen from the Activity Output Sample.

1. The beginning event number in unpacked form is found in words 3 thru 5 as BE. The level code is the second character of the 5th word. The ending event number is found in the 5th and 6th words as EE and its level code is the last character of the 6th word.

2. The Expected End Time may be computed time or an actual time. If the sign of word 14 is plus, the expected end time is a computed time. If the sign is minus the expected end time is an actual time and in this case an "A" should precede this time in the output and no latest end time or date is printed out. The time in either case is the AET in bits 21-35 of the 15th word. This time and also the corresponding date are to be included in the output.

3. The Latest End Time is the latest time of the ending event. The time is found in bits 21-35 of the 12th word. It may be negative, i.e., the computed latest time may occur before the base time or zero time of the program. This time and also the corresponding date are to be included in the output.

4. If the 14th word is positive, print out the Activity Time from bits S-12 of the 15th word and the Activity Sig from bits 13-20 of the 15th word. If the 14th word is negative, the TE in the 15th word is an actual time. In this case just leave the Activity Time, Activity Sig and Activity Slack fields blank, and jump to step 6.

5. The Activity Slack comes from bits 22-35 of the 14th word with its sign from bit 21 of that word. If this slack value equals 37777_8 print "ERROR" in the Activity Slack field. Otherwise convert and print the computed slack value.

6. If bit 1 of the 13th word is a one, the Scheduled Time and Date have been replaced by an actual time and hence should be left blank. If bit 1 of the 13th word is zero, check to see if bits 23-35 of the

13th word are zero. If so, no scheduled date has been given and blanks should be printed out for the scheduled time. If these bits are not zero they represent the scheduled time. Finally the 13th word contains the scheduled date if one is given and should be printed out in the output date format. If a scheduled date is given and bit 2 of the 13th word equals a 1, print an asterisk before the scheduled date to indicate that it was used in the latest date computation.

7. The Critical Predecessor is packed (4 bits per integer) in bits S-32 of the 10th word.

8. The Short Path Flag (SP) comes from the second character of the 3rd word.

9. The Event Slack comes from bits 6-20 (6 is the sign bit) of the 14th word. If this slack value equals 37777_8 print "ERROR" in the event slack field. If bit 1 of the 13th word is "1" leave the event slack field blank.

10. Finally, if bit 1 of word 13 equals one, the End Event Expected Date is an actual date. Print out an "A" preceding the date and calculate the date from the time in bits 21-35 of the 13th word. If bit 1 of the 13th word equals zero, the End Event Expected Date must be calculated. The End Event Expected Time equals LT(BEL + EE) - (Event Slack) where LT comes from bits 21-35 of the 12th word and the Event Slack from bits 6-20 of the 14th word. Convert this computed time to a date.

11. This completes the first line of activity information. On the second line print out the Activity Associated Information from words 16-18 to positions 25-42 and the Activity Title from words 19-24 to positions 43-78. The Activity Associated Information and the Activity Title together can be treated as a single Activity Title of 53 characters.

CHAPTER III

DATE/TIME SUBROUTINE

CHAPTER III

DATE/TIME SUBROUTINE

A single DATE/TIME Subroutine is used in the USAF PERT TIME program. The subroutine has three entrances serving the following functions: The start date of the network is converted to a time in days from January 1, 1945 by the Base-Date-to-Time (BDOT) entrance. All other dates are converted to a time in tenths of weeks from this start date by entering this subroutine at the Date-to-Time (DTOT) entrance. Finally the conversion of a time in tenths of weeks to a date is made through the Time-to-Date (TTOD) entrance.

The first two of the above entrances in turn call upon a calendar routine to convert a date to a time in days. The third entrance calls upon the same calendar routine to convert a time to a date.

A. Subroutine Entrances

The following steps describe the linkage between the three entrances and the calendar routine:

1. Entrance BDOT. Store the 6 digit start date in the Q register and zero in the accumulator. Enter the calendar routine (WICAR). If the error exit is taken from this routine set BT, the base time in days, to zero and exit. If the normal exit is made from the calendar routine, set BT to the time in the accumulator and exit.

2. Entrance DTOT. Store the 6 digit date in the Q register. Put zero in the accumulator and enter the calendar routine (WICAR). If the normal exit is taken from the calendar routine, subtract BT from the accumulator and divide the result by 5, giving a resulting time in tenths of weeks. If the error exit is taken print a message that the date was illegal, zero the accumulator and return.

3. Entrance TTOD. Multiply the time in the accumulator by 5 and add BT to the result giving a time in days in the accumulator. Store this result in the Q register and set the accumulator to a non zero value. Enter the calendar routine (WICAR). Convert the resulting date from the form MMDDYY (6 digits) to the form DDMMMYY where the month is a 3 letter abbreviation and store this in the accumulator and Q register as DDMMMY Y-----.

B. Calendar Routine

The calendar routine computes the number of workdays from a base date of January 1, 1945 to any given date, and also converts the number of workdays from January 1, 1945 to a calendar date. This routine is based on two premises. One is the cyclic nature of the calendar so that every 28 years it will repeat itself (except for certain century years), and the other is that every year and every month will begin on a predetermined day within the cycle.

In developing this program a table of 28 years has been set up. This table will suffice for any 28 year period in calendar time. This table, called TLNK, indicates how many workdays have elapsed up to a particular year and is shown in Figure III-1. The TLNK table also links into a second set of tables which are set up dependent upon the day that this particular year starts. If it is not a leap year, this second table, called TMON---TSUN, indicates how many workdays have elapsed up to a particular month. Figure III-2 shows the TMON---TSUN table. This table also indicates the holidays that have occurred up to this particular month and lists the holidays that fall in the month. It will permit up to 3 holidays in any one month. In the TMON---TSUN table there is a link to the TMWD table by the start-day of the month. From this table the number of workdays up to a particular day is determined. The TMWD table is shown in Figure III-3. If it is a leap year the second table is called TLMO---TLSU and contains two links. The first link is used if the month of the leap years fall prior to March. It returns to the TMON---TSUN table at the same location as if it were not a leap year. The second link is used for all months later than February. The days are modified by a value in the TLMO-TLSU table and then a return link is made to the TMON---TSUN table at a location one day later than the day on which the year starts. The TLMO---TLSU table is shown in Figure III-4.

The same tables are used for both the date-to-workday and workday-to-date conversions. This routine does not put out any dates that fall on Saturday, Sunday, or any of the holidays listed. Any date input to the system that falls on a Saturday, Sunday, or holiday will be handled as the last work day preceding the date. The program considers the following six holidays:

1. New Year's Day

2. Memorial Day

3. Independence Day

4. Labor Day

5. Thanksgiving

6. Christmas

Subsequent expected times are computed from the start event of the network. Therefore, consideration of the weekend and holiday dates does not affect total time computations for the network.

Link by Year into Calendar Tables
(Base Year - 1945)

Year of 28 Year Cycle	S-2	3-17	18-20	21-35	Representative Years
28		6883		TLSA	1972-2000-2028
27		6628		TFRI + 1	1971
26		6373		TTHU + 1	1970-1998-2026
25		6118		TWED + 1	
24		5862		TLMO	
23		5608		TSUN + 1	
22		5354		TSAT + 1	
21		5099		TFRI + 1	1965-1993-2021
20		4843		TLWE	
19		4588		TTUE + 1	
18		4333		TMON + 1	
17		4079		TSUN + 1	
16		3824		TLFR	1960-1988-2016
15		3569		TTHU + 1	
14		3314		TWED + 1	
13		3059		TTUE + 1	
12		2804		TLSU	
11		2550		TSAT + 1	1955-1983-2011
10		2295		TFRI + 1	
9		2040		TTHU + 1	
8		1784		TLTU	
7		1529		TMON + 1	
6		1275		TSUN + 1	1950-1978-2006
5		1021		TSAT + 1	1949
4		765		TLTH	1948
3		510		TWED + 1	1947
2		255		TTUE + 1	1946
1		0		TMON + 1	1945-1973-2001

Bits 3-17 - Number of workdays elapsed from start of cycle (less holidays)

Bits 21-35 - Link to day in TMON-TSUN Table or to TLMO-TLSU Table.

Figure III-1
TLINK Table

S-4	5-9	10-14	15-17	18-22	23-35		S-4	5-9	10-14	15-17	18-22	23-35	
25			5	5	240	Dec	1			1	30	107	Jun
22			4	15	218	Nov				1	10	86	May
			4	30	195	Oct	T			1	20	64	Apr
3			3	5	175	Sep	T			1	0	42	Mar
			3	20	152	Aug	H			1	0	22	Feb
4			2	0	130	Jul	U 1			0	15	0	Jan
			2	10	109	Jun	27			5	20	238	Dec
30			1	25	86	May	25			4	30	216	Nov
T			1	0	65	Apr				4	10	195	Oct
M			1	15	43	Mar	6			3	20	173	Sep
O			1	15	23	Feb				3	0	151	Aug
N 1			0	30	0	Jan	5			2	15	129	Jul
25			5	0	239	Dec				2	25	107	Jun
28			4	10	218	Nov	31			1	5	86	May
			4	25	195	Oct	T			1	15	64	Apr
2			3	0	174	Sep	F			1	30	41	Mar
			3	15	152	Aug	R			1	30	21	Feb
4			2	30	129	Jul	I 1			0	10	0	Jan
			2	5	109	Jun	26			5	15	238	Dec
30			1	20	86	May	24			4	25	216	Nov
T			1	30	64	Apr				4	5	195	Oct
T			1	10	43	Mar	5			3	15	173	Sep
U			1	10	23	Feb				3	30	150	Aug
E 1			0	25	0	Jan	4			2	10	129	Jul
25			5	30	238	Dec				2	20	107	Jun
27			4	5	218	Nov	30			1	0	85	May
			4	20	195	Oct	T			1	10	64	Apr
1			3	30	173	Sep	S			1	25	41	Mar
			3	10	152	Aug	A			1	25	21	Feb
4			2	25	129	Jul	T 3			0	5	0	Jan
			2	0	108	Jun	25			5	10	239	Dec
30			1	15	86	May	23			4	20	217	Nov
T			1	25	64	Apr				4	0	195	Oct
W			1	5	43	Mar	4			3	10	174	Sep
E			1	5	23	Feb				3	25	151	Aug
D 1			0	20	0	Jan	4			2	5	130	Jul
25			5	25	238	Dec				2	15	108	Jun
26			4	0	217	Nov	30			1	30	85	May
			4	15	195	Oct	T			1	5	65	Apr
7			3	25	173	Sep	S			1	20	42	Mar
			3	5	152	Aug	U			1	20	22	Feb
6			2	20	129	Jul	N 2			0	0	0	Jan

Bits S-4, 5-9, 10-14 Dates of holidays in a month.
15-17 Number of holidays in preceeding months.
18-22 Bits to be shifted in using TMWD Table.
23-35 Cumulative workdays by month in a year.

Figure III-2
TMON---TSUN Table

Cumulative Number of Workdays for Any Month
for a Given Day in the Table

		S	1-05	6-10	11-15	16-20	21-25	26-30	31-35
	31	0	23	23	23	22	21	21	22
	30		22	22	22	22	21	20	21
	29		21	21	21	21	21	20	20
	28		20	20	20	20	20	20	20
	27		20	19	19	19	19	19	20
	26		20	19	18	18	18	18	19
	25		19	19	18	17	17	17	18
	24		18	18	18	17	16	16	17
	23		17	17	17	17	16	15	16
	22		16	16	16	16	16	15	15
	21		15	15	15	15	15	15	15
	20		15	14	14	14	14	14	15
	19		15	14	13	13	13	13	14
	18		14	14	13	12	12	12	13
	17		13	13	13	12	11	11	12
Number of the Day in Month	16		12	12	12	12	11	10	11
	15		11	11	11	11	11	10	10
	14		10	10	10	10	10	10	10
	13		10	9	9	9	9	9	10
	12		10	9	8	8	8	8	9
	11		9	9	8	7	7	7	8
	10		8	8	8	7	6	6	7
	9		7	7	7	7	6	5	6
	8		6	6	6	6	6	5	5
	7		5	5	5	5	5	5	5
	6		5	4	4	4	4	4	5
	5		5	4	3	3	3	3	4
	4		4	4	3	2	2	2	3
	3		3	3	3	2	1	1	2
	2		2	2	2	2	1	0	1
	1	0	1	1	1	1	1	0	0
			Mon	Tue	Wed	Thu	Fri	Sat	Sun

Day on Which the Month Starts

Figure III-3
TMWD Table

Days tied to a month table

	S-11	12-17	18-20	21-35		
Dec	1 2	31		00000		
Nov	1 1	30		00000		
Oct	1 0	31		77712*	9	
Sep	0 9	30		77720	8	
Aug	0 8	31		77726	7	
Jul	0 7	31		77734	6	
Jun	0 6	30		77742	5	
May	0 5	31		77750	4	*Octal
Apr	0 4	30		77756	3	Numbers
Mar	0 3	31		77764	2	
Feb	0 2	28		77772	1	
Jan	0 1	31		00000	0	

S-11 - BCD Representation of the number of the month.
12-17 - Number of legitimate days in a month.
21-35 - Aid in converting BCD tens digit to binary in day-month-year.

	S-2	3-17	18-20	21-35
TLSU	2	TSUN + 1	0	TMON + 1
TLMO	3	TMON + 1	1	TTUE + 1
TLTU	3	TTUE + 1	1	TWED + 1
TLWE	2	TWED + 1	1	TTHU + 1
TLTH	1	TTHU + 1	1	TFRI + 1
TLFR	1	TFRI + 1	1	TSAT + 1
TLSA	1	TSAT + 1	0	TSUN + 1

Figure III-4
TLMO-TLSU Table

CHAPTER IV

THE PROGRAMMING SYSTEM

CHAPTER IV

THE PROGRAMMING SYSTEM

A. Basic Monitor System

The version of the Basic Monitor System used for USAF PERT is 7090/7094 IBSYS Processor, #7090-PR-130, Version 6. The following sub-systems of the IBSYS Processor are pertinent to USAF PERT operation:

1. IBSYS, #7090-SV-918
   Version 2, Modification Level 1

2. IBSFAP, #7090-SP-920
   Version 3, Modification Level 0

3. SORT, #7090-SM-922
   Version 4, Modification Level 0

4. IOCS, #7090-IO-919
   Version 4, Modification Level 1

5. 9PAC, #7090-PR-924
   Version 3, Modification Level 3

The ASD SYSUNI Table for the Basic Monitor is given below. The effect of various other SYSUNI configurations upon USAF PERT operation (in particular upon the use of SORT) is discussed in Section B, below.

ASD SYSUNI TABLE

SYSLB1	A1	SYSPPI	B1
SYSLB2	A2	SYSPP2	B2
SYSIN1	A3	SYSOU1	B3
SYSIN2	A4	SYSOU2	B4
SYSUT1	A5	SYSUT2	B5
SYSUT3	A6	SYSUT4	B6
SYSCK1	A7	SYSCK2	B7
SYSL3	Not Assigned	SYSLB4	Not Assigned

ASD has made additional installation modifications to the above systems to improve generally the Basic Monitor operation. Briefly, these modifications have the following effects on the system operation:

1. IBSYS modifications include the ASD SYSUNI Table and deletion of unnecessary on-line printing. The Start Nth job procedure also was found undesirable and has been replaced temporarily by one self-loading utility card, which merely positions SYSIN1 at the Nth "$ID"card, where N is in the address of the keys.

2. IOCS modifications include the deletion of unnecessary on-line printing, a change in reserve tape availability and the addition of a temporary absolute loader. As distributed by IBM, IOCS turns "on" its availability bit upon producing an intersystem reserve tape. Later, SORT erroneously requires the availability bit of this tape to be "off." An official correction to SORT is to be distributed soon, but IOCS has been modified temporarily to leave this availability bit "off." The temporary absolute loader in IOCS loads the standard 22 word card format.

3. SORT modifications include the reversing of the interpretation of Sense Switch 6 so that the normal (off) setting of SS6 suppresses on-line printing. Also SORT input tapes are rewound but not unloaded when these tapes are intersystem reserve tapes instead of always being unloaded as before. This eliminates the necessity of an operator again readying these tapes for subsequent use.

4. 9PAC modifications consist of printing alterations only.

The USAF PERT program execution time was reduced by ordering the sub-systems on SYSLB1 as follows:

1. IBSYS

2. IOCS

3. SORT

4. 9PAC

5. etc...

However, this ordering certainly is optional.

B. Tape Assignments

This section not only explains the tape assignments used in USAF PERT but discusses how they may be changed to accommodate the special needs of other installations.

As explained elsewhere in this volume, the distributed version of PERT presupposes the SYSUNI table in use at the Digital Computation Division, Aeronautical Systems Division, WPAFB. Fourteen of the 16 tapes on ASD's 7090 have SYSUNI functions, and the remaining two are attached but unassigned. PERT begins by releasing SYSIN2, SYSOU2, and SYSPP2. Therefore, when the actual process of tape assignments begins in PERT Phase I (sorting the update cards), the status of tapes is as follows:

> SYSUNI tapes UT1, UT2, UT3, UT4, CK1, CK2, and five unassigned tapes can be used by the program. SYSUNI tapes LB1, LB2, IN1, OU1, and PP1 are not used by PERT except for their normal system functions.

The five initially unassigned tapes are in the IBSYS Availability Chain and are controlled by PERT through the use of intersystem reserve unit designations on IOCS file cards, 9PAC file cards, and 90 SORT control cards. Listings of the program layout for the 12 and 16 tape versions at the end of this section show how files are assigned to the various tape units. It is particularly important to understand that utilization of the intersystem reserve units is dynamic. For example, J1 can refer to different physical tape units in different PERT runs and even within one run.

Although certain changes in file assignments can be made without difficulty, others must be made with extreme care. Most files assigned to SYSUNI-named tapes can be swapped around with impunity although some combinations are inferior to others in terms of channel utilization. However, subtle problems can occur with the five tapes initially in the Availability Chain. When 90 SORT is used, it draws its merge tapes from this stockpile. This means that at least two of these tapes must be on each channel and implies a restriction upon the possible SYSUNI tables that an installation might design and use. Furthermore, since one of these five tapes is in reserve status at the start of the Event Assembly Phase of PERT, there are only four tapes in the availability chain for 90 SORT to use as merge tapes and two of these tapes must be on each channel. Thus the unit in reserve status at the start of event assembly must be on the channel that originally had three available units, since 90 SORT only then will be able to find enough tapes on each channel for merge tapes. Careless manipulation of file assignments easily can result in arrival at event assembly with four tapes available but all of them on the same channel. In that case 90 SORT naturally would not run. Changes in file assignments and the use of different SYSUNI tables can be made successfully and easily if the requirements outlined above are met.

An installation having less than 16 tapes can economize by proper use of the following information:

1. LB2 and PP1 are not used at all.

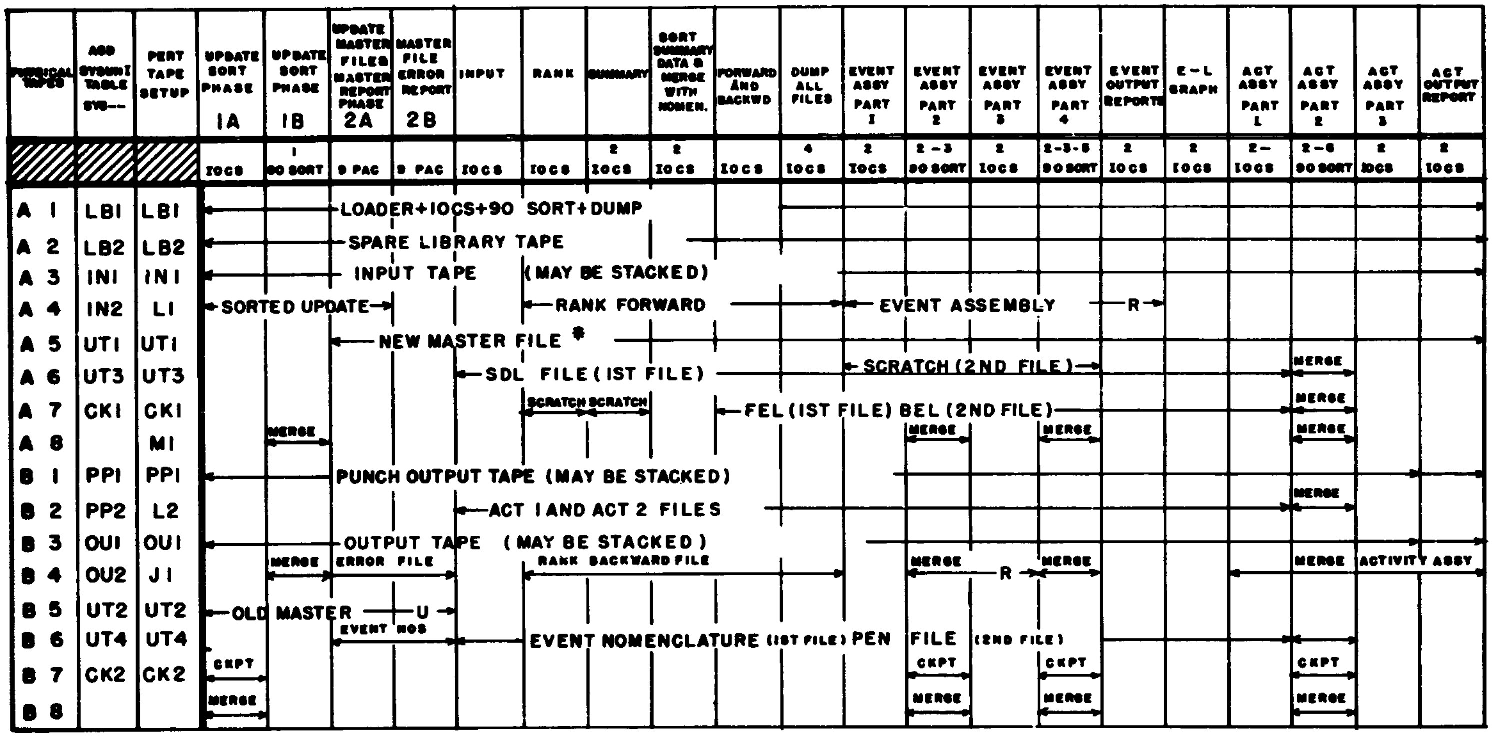
2. CK2 is used only by 90 SORT.

3. The OLD MASTER file (UT2) is not needed after the 9PAC file maintenance phase, after which it unloads.

From this it can be seen that, with suitable changes in the file specifications, USAF PERT could be run on a 7090 with as few as 12 tape units. On the other hand, installations with 16 tapes can improve the speed of PERT by releasing LB2 and PP1 and increasing the merge orders used in 90 SORT to third order. Naturally, any installation with still more tapes can exploit this possibility even further, although doing so may require reassembly of IBSYS to provide additional unit control blocks. PERT might be made to run on a 7090 with only 10 tape drives by an installation willing to rewrite and reassemble sections of the program in order to stack several files on one tape.

USAF PERT TAPE ASSIGNMENTS

16 TAPE SYSTEM



1. SKIPPED EXCEPT FOR RUNS HAVING A LARGE NUMBER OF UPDATE CARDS
2. SKIPPED IF NOT REQUESTED
3. SKIPPED EXCEPT FOR RUNS HAVING A LARGE NUMBER OF EVENTS
4. FOR DEBUGGING ONLY
5. SKIPPED IF ONLY EVENT ORDERED REPORT WAS REQUESTED
6. SKIPPED EXCEPT FOR RUNS HAVING LARGE NUMBER OF ACTIVITIES

"R" INDICATES THAT RESERVED TAPE IS RELEASED

"U" INDICATES THAT A TAPE IS REWOUND AND UNLOADED (UNIT NOT NEEDED AGAIN)

• IF THE ACTIVITY OUTPUT IS NOT REQUESTED, THIS TAPE WILL NOT BE USED AGAIN.

Figure IV-1

USAF PERT Tape Assignments (16-Tape System)

FILE CARDS 16-TAPE VERSION

```
$RELEASE       SYSPP2
$RELEASE       SYSOU2
$RELEASE       SYSIN2
$EXECUTE       IOCS
      *JOB  FIKE-PERT PHASE 1     6        11400      MINIMUM
      *FILE   1 *IN1      NI HD                       UNSORTED.UPDATES
      *FILE   2 *L1       NP HD                       SORTED.UPDATE.FILE
      *FILE   3 *OU1      NP HD                       MESSAGE.FILE
      *FILE   4 *L1       NP HD                       OVERFLOW.FILE
      *FILE   5 *UT2      NP HD                       DUMMY OLD MASTER
      *FILE 006 *IN1      NI HD                       SYSIN1
      *LOAD    SYSIN1

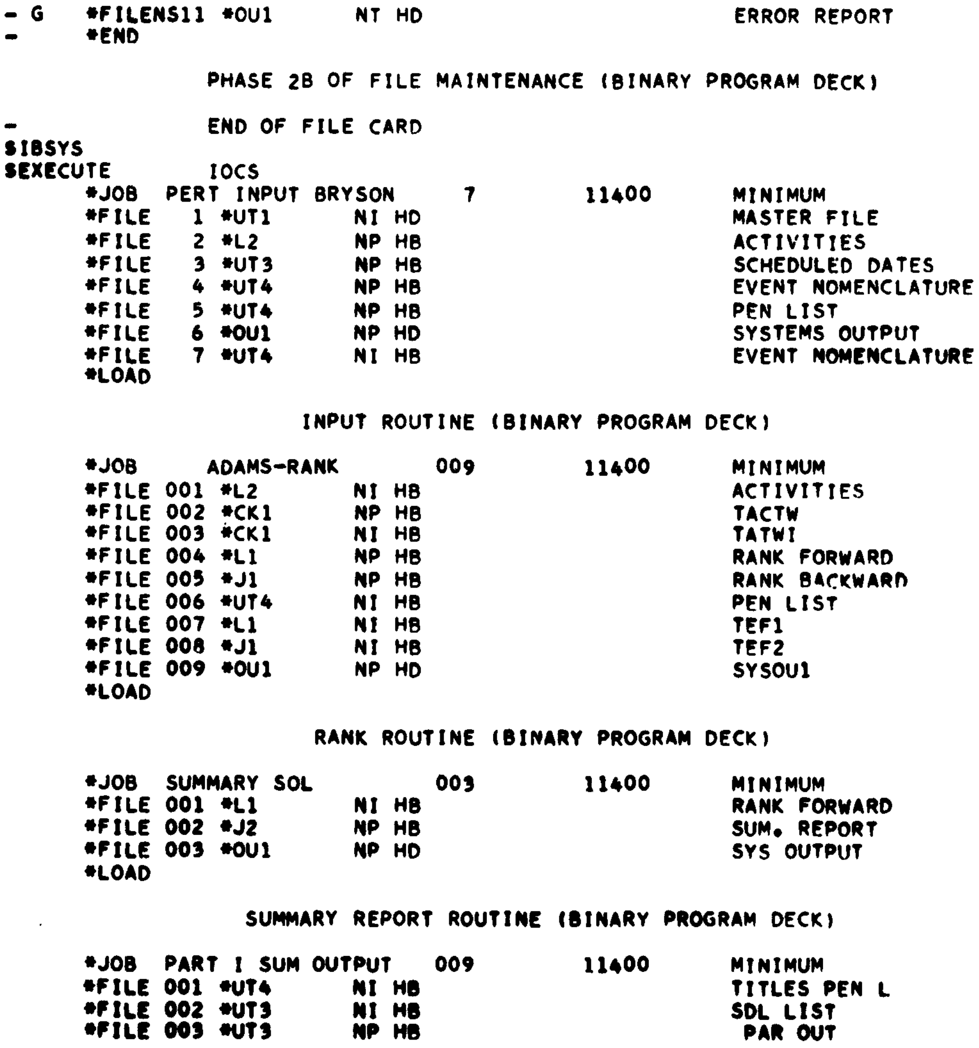
               PHASE 1A OF FILE MAINTENANCE (BINARY PROGRAM DECK)

-              END OF FILE CARD
-              END OF FILE CARD
$IBSYS                                 PHASE 1B
$EXECUTE       SORT
      OPTION,NOCKPT,VARIABLE BLOCKING
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1
      RECORD,LENGTH/14,TYPE/F,FIELDS/(1,4,8,2,8)
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/D,BLOCKSIZE/70
      FILE,OUTPUT,DENSITY/H,MODE/D,BLOCKSIZE/70
      SORT,FILE/1,SEQUENCE/C,ORDER/2,FIELDS/(5,3,1)
      END
$IBSYS
$EXECUTE       9PAC
      *JOB  FPBIN             PERT FILE UPDATE
-H0240*FILERU00 *UT2      NI HD                       OLD MASTER FILE
-H0240*FILERR10 *UT1      NI HD                        RPG INPUT
-H0240*FILERR07 *UT1      NT HD                       NEW MASTER FILE
-H0035*FILERR08 *J1       NT HD                       ERROR DATA FILE
- 0075*FILERR11 *L1       NI HD                       CHANGE DATA FILE
- G   *FILENS01 *OU1      NT HD                       RPG OUTPUT
- 0240*FILERR02 *UT4      NT HB                        PEN LIST FILE
-     *END

               PHASE 2A OF FILE MAINTENANCE (BINARY PROGRAM DECK)

-              END OF FILE CARD
      *JOB  RGBIN             PERT ERROR REPORT
-H0020*FILERR10 *J1       NI HD                       ERROR DATA FILE
```

Figure IV-2a
File Cards (16-Tape Version)



```
- G   *FILENS11 *OU1      NT HD                       ERROR REPORT
-     *END

               PHASE 2B OF FILE MAINTENANCE (BINARY PROGRAM DECK)

-              END OF FILE CARD
$IBSYS
$EXECUTE       IOCS
      *JOB  PERT INPUT BRYSON     7          11400      MINIMUM
      *FILE   1 *UT1      NI HD                       MASTER FILE
      *FILE   2 *L2       NP HB                       ACTIVITIES
      *FILE   3 *UT3      NP HB                       SCHEDULED DATES
      *FILE   4 *UT4      NP HB                       EVENT NOMENCLATURE
      *FILE   5 *UT4      NP HB                       PEN LIST
      *FILE   6 *OU1      NP HD                       SYSTEMS OUTPUT
      *FILE   7 *UT4      NI HB                       EVENT NOMENCLATURE
      *LOAD

                      INPUT ROUTINE (BINARY PROGRAM DECK)

      *JOB     ADAMS-RANK       009        11400      MINIMUM
      *FILE 001 *L2       NI HB                       ACTIVITIES
      *FILE 002 *CK1      NP HB                       TACTW
      *FILE 003 *CK1      NI HB                       TATWI
      *FILE 004 *L1       NP HB                       RANK FORWARD
      *FILE 005 *J1       NP HB                       RANK BACKWARD
      *FILE 006 *UT4      NI HB                       PEN LIST
      *FILE 007 *L1       NI HB                       TEF1
      *FILE 008 *J1       NI HB                       TEF2
      *FILE 009 *OU1      NP HD                       SYSOU1
      *LOAD

                       RANK ROUTINE (BINARY PROGRAM DECK)

      *JOB  SUMMARY SOL         003        11400      MINIMUM
      *FILE 001 *L1       NI HB                       RANK FORWARD
      *FILE 002 *J2       NP HB                       SUM. REPORT
      *FILE 003 *OU1      NP HD                       SYS OUTPUT
      *LOAD

                  SUMMARY REPORT ROUTINE (BINARY PROGRAM DECK)

      *JOB  PART I SUM OUTPUT   009        11400      MINIMUM
      *FILE 001 *UT4      NI HB                       TITLES PEN L
      *FILE 002 *UT3      NI HB                       SDL LIST
      *FILE 003 *UT3      NP HB                        PAR OUT
```

Figure IV·2b
File Cards (16-Tape Version)

```
      *FILE 004 *J2R      NI HB                       SUMMARY REPORT
      *FILE 005 *M1       NP HB                       1/3/6-CODES OUT
      *FILE 006 *M1       NI HB                       1/3/6-CODES IN
      *FILE 007 *IN1      NI HM                       SYS INPUT
      *FILE 008 *PP1      NP HD                       CARD OUTPUT
      *FILE 009 *OU1      NP HD                       SYS OUTPUT
      *LOAD

              PART IA SUMMARY OUTPUT ROUTINE (BINARY PROGRAM DECK)

$IBSYS                                 PART IB
$* REMOVE B5, REPLACE WITH A BLANK TAPE.
$PAUSE
$RELEASE       SYSUT2
$RELEASE       SYSCK1
$EXECUTE       SORT
      OPTION,NOCKPT,VARIABLE BLOCKING
      CHANNELS,INPUT/M1R,MERGE/(A,B),OUTPUT/M1
      RECORD,LENGTH/8,TYPE/F,FIELD/32B
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/248
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/248
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/1
      END
$IBSYS
$ATTACH        A7
$AS            SYSCK1
$EXECUTE       IOCS
      *JOB  PART II SUM OUTPUT  005        11400      MINIMUM
      *FILE 001 *M1R      NI HB                       SORTED DATA
      *FILE 002 *UT4      NI HB                       TITLES PEN L
      *FILE 003 *UT3      NI HB                       PAR (SDL)
      *FILE 004 *PP1      NP HD                       CARD OUTPUT
      *FILE 005 *OU1      NP HD                       SYS OUTPUT
      *LOAD

              PART II SUMMARY OUTPUT ROUTINE (BINARY PROGRAM DECK)

      *JOB  EVENTS FWE-BKE GA   008        11400      MINIMUM
      *FILE 001 *UT3      NI HB                       SCHEDULED DATES
      *FILE 002 *CK1      NP HB                       FORWARD EVENTS-FEL
      *FILE 003 *L1       NI HB                       RANK FORWARD
      *FILE 004 *UT4      NI HB                       PEN LIST
      *FILE 005 *OU1      NP HD                       SYSTEM OUTPUT
      *FILE 006 *UT3      NP HB                       FINAL SDL LIST
      *FILE 007 *J1       NI HB                       RANK REVERSE
      *FILE 008 *M1R      NP HB                       SUM. OUTPUT DATA
```

Figure IV-2c
File Cards (16-Tape Version)

```
      *LOAD

         FORWARD AND BACKWARD EVENT LIST ROUTINES (BINARY PROGRAM DECK)

      *JOB  FIKE DUMP CODE      009        20000      BASIC
      *FILE 001 *UT3      NI HB                       SDL
      *FILE 002 *UT4      NI HB                       ENOM
      *FILE 003 *UT4      NI HB                       PEN
      *FILE 004 *L2       NI HB                       ACTIV
      *FILE 005 *L1       NI HB                       RANK
      *FILE 006 *J1R      NI HB                       RANK REVERSE
      *FILE 007 *CK1      NI HB                       FEL
      *FILE 008 *CK1      NI HB                       BEL
      *FILE 009 *LB2      NP HB                       DUMP
      *LOAD

     ERROR CHECK ROUTINE - DUMP SDL, TITLES, PEN, ACTIVITIES, RANK,
       RANK REVERSE, FEL AND BEL (BINARY PROGRAM DECK)

      *JOB  PERT EVENT ASSEM    012        11400      MINIMUM
      *FILE  01 *CK1      NI HB                       FELF
      *FILE  02 *UT4      NI HB                       PENF
      *FILE  03 *CK1      NI HB                       BELF
      *FILE  04 *UT3      NI HB                       SDLF
      *FILE  05 *UT4      NI HB                       ENOMF
      *FILE 006 *L1       NP HB                       EALT
      *FILE 007 *L1       NP HB                       EAPAT
      *FILE 008 *L1       NP HB                       EASOT
      *FILE  09 *UT3      NP HB                       EACOR
      *FILE  10 *IN1      NI HM                       EASYI
      *FILE 011 *L1       NP HB                       EAENF
      *FILE  12 *OU1      NP HD                       EAERF
      *LOAD

              PART IA EVENT ASSEMBLY ROUTINE (BINARY PROGRAM DECK)

$IBSYS                                 PART IB
$IBSYS
$EXECUTE       SORT
      OPTION,NOCKPT,VARIABLEBLOCKING
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/J1
      RECORD,LENGTH/6,TYPE/F,FIELD/32B
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/246
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/246
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/1
      END
```

Figure IV-2d
File Cards (16-Tape Version)

```
$IBSYS
$EXECUTE       IOCS
      *JOB  EVENT ASSEM PART2   008        11460      MINIMUM
      *FILE  01 *UT4       NI HB                      ENOMF
      *FILE 002 *L1        NP HB                      EALT
      *FILE 003 *J1R       NI HB                      EAPAT
      *FILE 004 *L1        NP HB                      EASOT
      *FILE  05 *UT3       NP HB                      EACOR
      *FILE  06 *IN1       NI HM                      EASYI
      *FILE  07 *UT3       NI HB                      EA55T
      *FILE  08 *OU1       NP HD                      EAERF
      *LOAD

             PART IIA EVENT ASSEMBLY ROUTINE (BINARY PROGRAM DECK)

$IBSYS                                 PART IIB
$EXECUTE       SORT
      OPTION,NOCKPT,VARIABLEBLOCKING
      RECORD,LENGTH/14,TYPE/F,FIELD/(36B,36BS)
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/238
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/238
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/(1,2)
      END
$IBSYS
$EXECUTE       IOCS
      *JOB  EVENT PRINTOUT      002        11400      MINIMUM
      *FILE 001 *L1        NI HB                      EVENT ASSEMBLY
      *FILE 002 *OU1       NP HD                      SYSOU1
      *LOAD

                   EVENT OUTPUT ROUTINE (BINARY PROGRAM DECK)

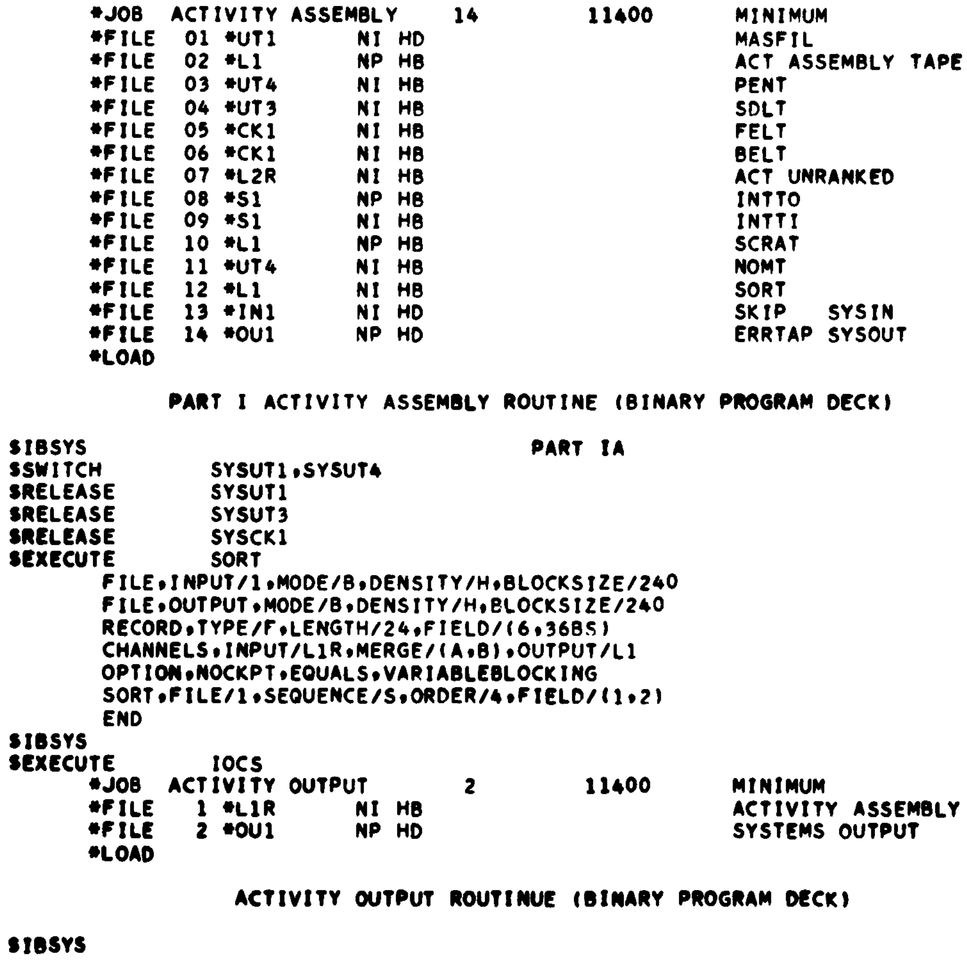
      *JOB  E-L CHART           002        11400      MINIMUM
      *FILE 001 *L1        N1 HB                      EVENT ASSEMBLY
      *FILE 002 *OU1       NP HD                      SYSOU1
      *LOAD

                    E-L CHART ROUTINE (BINARY PROGRAM DECK)

      *JOB  E-L MONTH CHART     002        11400      MINIMUM
      *FILE 001 *L1        N1 HB                      EVENT ASSEMBLY
      *FILE 002 *OU1       NP HD                      SYSOU1
      *LOAD

                 E-L MONTH CHART ROUTINE (BINARY PROGRAM DECK)
```

Figure IV-2e
File Cards (16-Tape Version)



```
         *JOB  ACTIVITY ASSEMBLY     14        11400       MINIMUM
         *FILE  01 *UT1       NI HD                        MASFIL
         *FILE  02 *L1        NP HB                        ACT ASSEMBLY TAPE
         *FILE  03 *UT4       NI HB                        PENT
         *FILE  04 *UT3       NI HB                        SDLT
         *FILE  05 *CK1       NI HB                        FELT
         *FILE  06 *CK1       NI HB                        BELT
         *FILE  07 *L2R       NI HB                        ACT UNRANKED
         *FILE  08 *S1        NP HB                        INTTO
         *FILE  09 *S1        NI HB                        INTTI
         *FILE  10 *L1        NP HB                        SCRAT
         *FILE  11 *UT4       NI HB                        NOMT
         *FILE  12 *L1        NI HB                        SORT
         *FILE  13 *IN1       NI HD                        SKIP   SYSIN
         *FILE  14 *OU1       NP HD                        ERRTAP SYSOUT
         *LOAD

               PART I ACTIVITY ASSEMBLY ROUTINE (BINARY PROGRAM DECK)

$IBSYS                                  PART IA
$SWITCH        SYSUT1,SYSUT4
$RELEASE       SYSUT1
$RELEASE       SYSUT3
$RELEASE       SYSCK1
$EXECUTE       SORT
       FILE,INPUT/1,MODE/B,DENSITY/H,BLOCKSIZE/240
       FILE,OUTPUT,MODE/B,DENSITY/H,BLOCKSIZE/240
       RECORD,TYPE/F,LENGTH/24,FIELD/(6,36BS)
       CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1
       OPTION,NOCKPT,EQUALS,VARIABLEBLOCKING
       SORT,FILE/1,SEQUENCE/S,ORDER/4,FIELD/(1,2)
       END
$IBSYS
$EXECUTE       IOCS
         *JOB  ACTIVITY OUTPUT        2        11400       MINIMUM
         *FILE   1 *L1R       NI HB                        ACTIVITY ASSEMBLY
         *FILE   2 *OU1       NP HD                        SYSTEMS OUTPUT
         *LOAD

                    ACTIVITY OUTPUT ROUTINUE (BINARY PROGRAM DECK)

$IBSYS
```

Figure IV-2f
File Cards (16-Tape Version)

```
                           FILE CARDS 12-TAPE VERSION

$DETACH        87
$DETACH        A2
$DETACH        B1
$DETACH        A7
$*MOUNT TAPES AS SPECIFIED ON REQUEST.
$PAUSE
$RELEASE       SYSPP2
$RELEASE       SYSOU2
$RELEASE       SYSIN2
$EXECUTE       IOCS
      *JOB  FIKE-PERT PHASE 1     6        11400      MINIMUM
      *FILE   1 *IN1      NI HD                       UNSORTED.UPDATES
      *FILE   2 *L1       NP HD                       SORTED.UPDATE.FILE
      *FILE   3 *OU1      NP HD                       MESSAGE.FILE
      *FILE   4 *L1       NP HD                       OVERFLOW.FILE
      *FILE   5 *UT2      NP HD                       DUMMY OLD MASTER
      *FILE 006 *IN1      NI HD                       SYSIN1
      *LOAD    SYSIN1

               PHASE 1A OF FILE MAINTENANCE (BINARY PROGRAM DECK)

-              END OF FILE CARD
-              END OF FILE CARD
$IBSYS                                 PHASE 1P
$EXECUTE       SORT
      OPTION,NOCKPT,VARIABLE BLOCKING
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1
      RECORD,LENGTH/14,TYPE/F,FIELDS/(1,4,8,2,8)
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/D,BLOCKSIZE/70
      FILE,OUTPUT,DENSITY/H,MODE/D,BLOCKSIZE/70
      SORT,FILE/1,SEQUENCE/C,ORDER/2,FIELDS/(5,3,1)
      END
$IBSYS
$EXECUTE       9PAC
      *JOB  FPBIN          PERT FILE UPDATE
-H0240*FILERU00 *UT2      NI HD                       OLD MASTER FILE
-H0240*FILERR10 *UT1      NI HD                        RPG INPUT
-H0240*FILERR07 *UT1      NT HD                       NEW MASTER FILE
-H0035*FILERR08 *J1       NT HD                       ERROR DATA FILE
- 0075*FILERR11 *L1       NI HD                       CHANGE DATA FILE
- G   *FILENS01 *OU1      NT HD                       RPG OUTPUT
- 0240*FILERR02 *UT4      NT HB                        PEN LIST FILE
-     *END
```

Figure IV-3a
File Cards (12-Tape Version)

```
               PHASE 2A OF FILE MAINTENANCE (BINARY PROGRAM DECK)

-              END OF FILE CARD
      *JOB  RGBIN             PERT ERROR REPORT
-H0020*FILERR10 *J1       NI HD                       ERROR DATA FILE
- G   *FILENS11 *OU1      NT HD                       ERROR REPORT
-     *END

               PHASE 2B OF FILE MAINTENANCE (BINARY PROGRAM DECK)

-              END OF FILE CARD
$IBSYS
$EXECUTE       IOCS
      *JOB  PERT INPUT BRYSON      7       11400      MINIMUM
      *FILE   1 *UT1      NI HD                       MASTER FILE
      *FILE   2 *L2       NP HB                       ACTIVITIES
      *FILE   3 *UT3      NP HB                       SCHEDULED DATES
      *FILE   4 *UT4      NP HB                       EVENT NOMENCLATURE
      *FILE   5 *UT4      NP HB                       PEN LIST
      *FILE   6 *OU1      NP HD                       SYSTEMS OUTPUT
      *FILE   7 *UT4      NI HB                       EVENT NOMENCLATURE
      *LOAD

                      INPUT ROUTINE (BINARY PROGRAM DECK)

      *JOB     ADAMS-RANK       009        11400      MINIMUM
      *FILE 001 *L2       NI HB                       ACTIVITIES
      *FILE 002 *UT2      NP HB                       TACTW
      *FILE 003 *UT2      NI HB                       TATWI
      *FILE 004 *L1       NP HB                       RANK FORWARD
      *FILE 005 *J1       NP HB                       RANK BACKWARD
      *FILE 006 *UT4      NI HB                       PEN LIST
      *FILE 007 *L1       NI HB                       TEF1
      *FILE 008 *J1       NI HB                       TEF2
      *FILE 009 *OU1      NP HD                       SYSOU1
      *LOAD

                       RANK ROUTINE (BINARY PROGRAM DECK)

      *JOB  SUMMARY SOL         003        11400      MINIMUM
      *FILE 001 *L1       NI HB                       RANK FORWARD
      *FILE 002 *UT2      NP HB                       SUM. REPORT
      *FILE 003 *OU1      NP HD                       SYS OUTPUT
      *LOAD
```

Figure IV-3b
File Cards (12-Tape Version)

```
                 SUMMARY REPORT ROUTINE (BINARY PROGRAM DECK)

$IBSYS
$ATTACH       A8 TAPE UNIT FOR SUMMARY OUTPUT COULD BE B8
$AS           SYSPP1,H
$EXECUTE      IOCS
      *JOB  PART I SUM OUTPUT  009        11400      MINIMUM
      *FILE 001 *UT4      NI HB                      TITLES PEN L
      *FILE 002 *UT3      NI HB                      SDL LIST
      *FILE 003 *UT3      NP HB                      PAR OR SOUT DATA
      *FILE 004 *UT2      NI HB                      SUMMARY REPORT
      *FILE 005 *PP1      NP HB                      1/3/4/6-CODES OUT
      *FILE 006 *PP1      NI HB                      1/3/4/6-CODES IN
      *FILE 007 *IN1      NI HM                      SYS INPUT
      *FILE 008 *PP1      NP HD                      CARD OUTPUT
      *FILE 009 *OU1      NP HD                      SYS OUTPUT
      *LOAD

             PART IA SUMMARY OUTPUT ROUTINE (BINARY PROGRAM DECK)

$IBSYS
$ENDFILE      SYSPP1
$ENDFILE      SYSPP1
$ENDFILE      SYSPP1
$REMOVE       SYSPP1 REWIND AND UNLOAD SUMMARY OUTPUT
$*OR IF SUMMARY WAS NOT REQUESTED RELOAD AND READY A8
$*IF SUMMARY OUT PUT WAS REQUESTED,A8 CONTAINS SUMMARY OUTPUT.   T/C
$*MOUNT NEW TAPE ON A8 AND PRESS START TO CONTINUE
$*THIS IS NOT NECESSARY ON 16 TAPE VERSION.
$RELEASE      SYSPP1
$PAUSE
$EXECUTE      IOCS
      *JOB  EVENTS FWE-BKE GA  007        11400      MINIMUM
      *FILE 001 *UT3      NI HB                      SCHEDULED DATES
      *FILE 002 *UT2      NP HB                      FORWARD EVENTS-FEL
      *FILE 003 *L1       NI HB                      RANK FORWARD
      *FILE 004 *UT4      NI HB                      PEN LIST
      *FILE 005 *OU1      NP HD                      SYSTEM OUTPUT
      *FILE 006 *UT3      NP HB                      FINAL SDL LIST
      *FILE 007 *J1       NI HB                      RANK REVERSE
      *LOAD

         FORWARD AND BACKWARD EVENT LIST ROUTINES (BINARY PROGRAM DECK)

      *JOB  FIKE DUMP CODE     009        20000      BASIC
      *FILE 001 *UT3      NI HB                      SDL
```

Figure IV-3c
File Cards (12-Tape Version)

```
      *FILE 002 *UT4      NI HB                       ENOM
      *FILE 003 *UT4      NI HB                       PEN
      *FILE 004 *L2       NI HB                       ACTIV
      *FILE 005 *L1       NI HB                       RANK
      *FILE 006 *J1R      NI HB                       RANK REVERSE
      *FILE 007 *UT2      NI HB                       FEL
      *FILE 008 *UT2      NI HB                       BEL
      *FILE 009 *LB2      NP HB                       DUMP
      *LOAD

     ERROR CHECK ROUTINE - DUMP SDL, TITLES, PEN, ACTIVITIES, RANK,
       RANK REVERSE, FEL AND BEL (BINARY PROGRAM DECK)

      *JOB  PERT EVENT ASSEM    012        11400      MINIMUM
      *FILE  01 *UT2      NI HB                       FELF
      *FILE  02 *UT4      NI HB                       PENF
      *FILE  03 *UT2      NI HB                       BELF
      *FILE  04 *UT3      NI HB                       SDLF
      *FILE  05 *UT4      NI HB                       ENOMF
      *FILE 006 *L1       NP HB                       EALT
      *FILE 007 *L1       NP HB                       EAPAT
      *FILE 008 *L1       NP HB                       EASOT
      *FILE  09 *UT3      NP HB                       EACOR
      *FILE  10 *IN1      NI HM                       EASYI
      *FILE 011 *L1       NP HB                       EAENF
      *FILE  12 *OU1      NP HD                       EAERF
      *LOAD

              PART IA EVENT ASSEMBLY ROUTINE (BINARY PROGRAM DECK)

$IBSYS                                 PART IB
$EXECUTE       SORT
      OPTION,NOCKPT,VARIABLEBLOCKING
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/J1
      RECORD,LENGTH/6,TYPE/F,FIELD/32B
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/246
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/246
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/1
      END
$IBSYS
$EXECUTE       IOCS
      *JOB  EVENT ASSEM PART2   008        11460      MINIMUM
      *FILE  01 *UT4      NI HB                       ENOMF
      *FILE 002 *L1       NP HB                       EALT
      *FILE 003 *J1R      NI HB                       EAPAT
      *FILE 004 *L1       NP HB                       EASOT
```

Figure IV-3d
File Cards (12-Tape Version)

```
      *FILE  05 *UT3     NP HB                       EACOR
      *FILE  06 *IN1     NI HM                       EASYI
      *FILE  07 *UT3     NI HB                       EA55T
      *FILE  08 *OU1     NP HD                       EAERF
      *LOAD

             PART IIA EVENT ASSEMBLY ROUTINE (BINARY PROGRAM DECK)

$IBSYS                                 PART IIB
$EXECUTE       SORT
      OPTION,NOCKPT,VARIABLEBLOCKING
      RECORD,LENGTH/14,TYPE/F,FIELD/(36B,36BS)
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/238
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/238
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/(1,2)
      END
$IBSYS
$EXECUTE       IOCS
      *JOB  EVENT PRINTOUT      002        11400      MINIMUM
      *FILE 001 *L1      NI HB                       EVENT ASSEMBLY
      *FILE 002 *OU1     NP HD                       SYSOU1
      *LOAD

                   EVENT OUTPUT ROUTINE (BINARY PROGRAM DECK)

      *JOB  E-L CHART           002        11400      MINIMUM
      *FILE 001 *L1      N1 HB                       EVENT ASSEMBLY
      *FILE 002 *OU1     NP HD                       SYSOU1
      *LOAD

                    E-L CHART ROUTINE (BINARY PROGRAM DECK)

      *JOB  E-L MONTH CHART     002        11400      MINIMUM
      *FILE 001 *L1      N1 HB                       EVENT ASSEMBLY
      *FILE 002 *OU1     NP HD                       SYSOU1
      *LOAD

                 E-L MONTH CHART ROUTINE (BINARY PROGRAM DECK)

      *JOB  ACTIVITY ASSEMBLY    14        11400      MINIMUM
      *FILE  01 *UT1     NI HD                       MASFIL
      *FILE  02 *L1      NP HB                       ACT ASSEMBLY TAP
      *FILE  03 *UT4     NI HB                       PENT
      *FILE  04 *UT3     NI HB                       SDLT
      *FILE  05 *UT2     NI HB                       FELT
```

Figure IV-3e
File Cards (12-Tape Version)

```
      *FILE  06 *UT2       NI HB                         BELT
      *FILE  07 *L2R       NI HB                         ACT UNRANKED
      *FILE  08 *S1        NP HB                         INTTO
      *FILE  09 *S1        NI HB                         INTTI
      *FILE  10 *L1        NP HB                         SCRAT
      *FILE  11 *UT4       NI HB                         NOMT
      *FILE  12 *L1        NI HB                         SORT
      *FILE  13 *IN1       NI HD                         SKIP   SYSIN
      *FILE  14 *OU1       NP HD                         ERRTAP SYSOUT
      *LOAD

            PART IA ACTIVITY ASSEMBLY ROUTINE (BINARY PROGRAM DECK)

$IBSYS                       PART 1A
$SWITCH        SYSUT1,SYSUT4
$RELEASE       SYSUT1
$RELEASE       SYSUT3
$RELEASE       SYSUT2
$EXECUTE       SORT
       FILE,INPUT/1,MODE/B,DENSITY/H,BLOCKSIZE/240
       FILE,OUTPUT,MODE/B,DENSITY/H,BLOCKSIZE/240
       RECORD,TYPE/F,LENGTH/24,FIELD/(6,36BS)
       CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1
       OPTION,NOCKPT,EQUALS,VARIABLEBLOCKING
       SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/(1,2)
       END
$IBSYS
$EXECUTE       IOCS
      *JOB  ACTIVITY OUTPUT       2        11400      MINIMUM
      *FILE   1 *L1R        I HB                         ACT ASSM-COST INPT
      *FILE   2 *OU1       NP HD                         SYSTEMS OUTPUT
      *LOAD

                 ACTIVITY OUTPUT ROUTINE (BINARY PROGRAM DECK)

$IBSYS
```

Figure IV-3f
File Cards (12-Tape Version)

CHAPTER V

COMPILATION PROCEDURE

CHAPTER V

COMPILATION PROCEDURE

A. PERT Editor

Since USAF PERT is a mixed system of IBSFAP, IOCS, 9PAC and 90 SORT requiring many control cards, an editor was included to permit symbolic maintenance and complete regeneration of the object program including control cards. The PERT editor described in this chapter fulfills these basic requirements by providing an editor card deck which will update and reassemble a symbolic tape into a complete object program.

B. PERT Symbolic Tape

The PERT symbolic tape, sequenced with ascending alphabetic characters in card columns 73 through 75, contains the various symbolic programs:

```
File 1 - 9PAC Programs              Starting Card Sequence

$EXECUTE  9PAC                                 BUP01000
    *JOB  (Dictionary establishment)
    *FILE (3 file cards used for compilation)
    *END
        9PAC program to establish
        the dictionary.
    *END
    *JOB  (File update program)                CUP01000
    *FILE (7 file cards used for compilation)
    *END
$IBSYS
$ENDFILE  SYSPP1
$EXECUTE  9PAC
    *JOB  (PERT error program)                 DUP01000
    *FILE (2 file cards for compilation)
    *END
        PERT error 9PAC program

    *END
$IBSYS
$ENDFILE  SYSPP1
$REWIND   SYSPP1
$SWITCH   SYSIN1, SYSCK2
```

File 2 - PERT Phase I	Starting Card Sequence
Phase I FAP program	ESR01000
with end card seq. no.	ESR99990
File 3 - Main PERT Programs	
Input Phase	GIN01000
Rank	HRK01000
Summary	ISM01000
Summary Output Part 1	IS001000
Summary Output Part 2	ISP01000
Forward-Backward Event	JFW01000
Debug	KDB01000
Event Assembly Part 1	LEA01000
Event Assembly Part 2	MEA01000
Event Output	NE001000
E-L Graph Week Chart	OEL01000
E-L Graph Month Chart	OEM01000
Activity Assembly	PAA01000
Activity Output	RA001000

NOTE: All FAP programs begin with the COUNT card and finish with the END card. The END card must have a sequence number of 99990 and a symbolic transfer name identical to the END card in the editor deck.

C. PERT Editor Deck

The PERT editor deck contains the FAP control cards for the IBSFAP updating, basic monitor control cards for the object PERT program, and an IOCS program to insert the 9PAC programs into the correct location in the object program. These various sections are shown in the attached listing as follows:

1. Editor control cards as sequenced with EDIT in column 65-68.

2. Basic monitor control cards with the proper system sequence number in column 73-80.

3. Special IOCS program with sequence number PTED in column 73-76.

The editor deck will run on a 12 Tape IBM 7090/94 with the tapes as follows:

	Tape Use	
1.	Basic monitor	SYSLB1
2.	Editor deck	SYSIN1
3.	Symbolic tape	SYSCK1
4.	Blank for the new symbolic tape	SYSCK2
5.	Blank for the listing	SYSOU1
6.	Blank for the object program (This tape must be on physical drive B1)	SYSPP1
7.	Blank	SYSPP2
8.	Blank	SYSUT1
9.	Blank	SYSUT2
10.	Blank	SYSUT3
11.	Blank	SYSUT4
12.	Blank	J1 (any available tape)

After mounting the tapes as shown, the PERT system is reassembled by pressing the load tape button and removing the desired tapes when complete.

The editor deck has the following phases of operation:

1. SYSCK1, SYSCK2, and SYSPP1 are rewound.

2. The 9PAC programs are updated without assembly from SYSCK1 to SYSCK2. An end of file is written on SYSCK2 before the tape is rewound.

3. SYSPP1 and SYSPP2 are switched to allow 9PAC to compile the object decks on SYSPP2. SYSIN1 and SYSCK2 (the updated 9PAC programs) are switched to give control to 9PAC for the necessary compilation. Since 9PAC must execute after compilation, blank data cards and end of files are provided in the editor deck. The last card of the updated symbolic tape which is now SYSIN1 provides for the switch back to the normal input tape leaving its results as follows:

   SYSPP2 - binary programs with dummy file cards
   J1 - 9PAC dictionary.

4. SYSPP1 and SYSPP2 are switched back to their original status to permit the PERT object program to be assembled on SYSPP1.

5. The end of file is rewritten on SYSCK2.

6. Physical drive B1 is attached as SYSUT2 allowing an update to logical tape 8 to put the PERT basic monitor control cards on SYSPP1.

7. The basic monitor control cards for PERT Phase I are updated without assembly to SYSPP1 followed by the assembly of Phase I.

8. The special IOCS program is entered to insert the 9PAC programs as follows:

   a. The 9PAC dictionary is sequenced and copied from J1 to SYSPP1 while being listed on SYSOU1.

   b. Two end of files required by the object program are written on SYSPP1.

   c. The Phase I 90 SORT program is copied and listed from SYSIN1 to SYSPP1 and SYSOU1 respectively.

   d. After rewinding SYSCK2, the 9PAC symbolic programs are listed on SYSOU1 and the tape is repositioned after the second file.

   e. The $EXECUTE and *JOB cards in the editor deck for the first 9PAC program are copied to SYSPP1 and SYSOU1.

   f. The 9PAC *FILE and *END cards are copied from the editor deck to SYSOU1 and converted to binary for SYSPP1.

   g. The eight dummy 9PAC file and END cards with the update object program on SYSPP2 are skipped before the object program is copied to SYSPP1.

h. Steps e, f, and g are repeated for the second 9PAC program except only 3 cards are skipped on SYSPP2 and no $EXECUTE is copied.

9. The basic monitor control cards for the PERT input phase are updated without assembly to SYSPP1 followed by the assembly of the input phase.

10. Step 9 is repeated for each PERT program.

11. An end of file is written on SYSCK2 before rewinding and unloading SYSCK1 and SYSCK2.

12. At the end of the edit run, the complete listing is on SYSOU1 and the object programs with control cards are on SYSPP1. When tape-to-carding SYSPP1 be sure that an EOF card is punched for each EOF mark on the SYSPP1 tape.

D. Updating with the Editor

This section of the report will discuss the normal symbolic maintenace of the PERT system and the procedure for assembling individual programs.

Normal symbolic changes can be added to the system during the reassembly by adding sequenced symbolic cards in the editor deck preceding the last card of the particular section requiring changes. This last card is sequenced with the prefix for that section and 99990 in column 76 to 80. Insertions, deletions and modifications must follow the rules specified for updating in the FAP manual. The PERT monitor control cards including the IOCS file cards may be changed directly in the editor deck.

Any of the FAP sections of PERT may be reassembled individually by the following procedure.

1. Make a special editor program with

```
$EXECUTE          IBSFAP
    *FAP
     UPDATE       9, 10, U (with program prefix
                  and 00000 in column 73-80)
     END          (GIVE transfer name in column 16
                  and the program prefix followed
                  by 99990 in 73-80)
```

$IBSYS

2. Mount the symbolic tape on SYSCK1 and a blank on SYSCK2.

3. Mount special editor on SYSIN1 and load tape.

The 9PAC program could be reassembled as follows:

1. Mount the symbolic tape on SYSCK2.

2. Mount a program containing a $SWITCH, SYSIN1, SYSCK2 card on SYSIN1.

3. Press load tape.

E. Summary

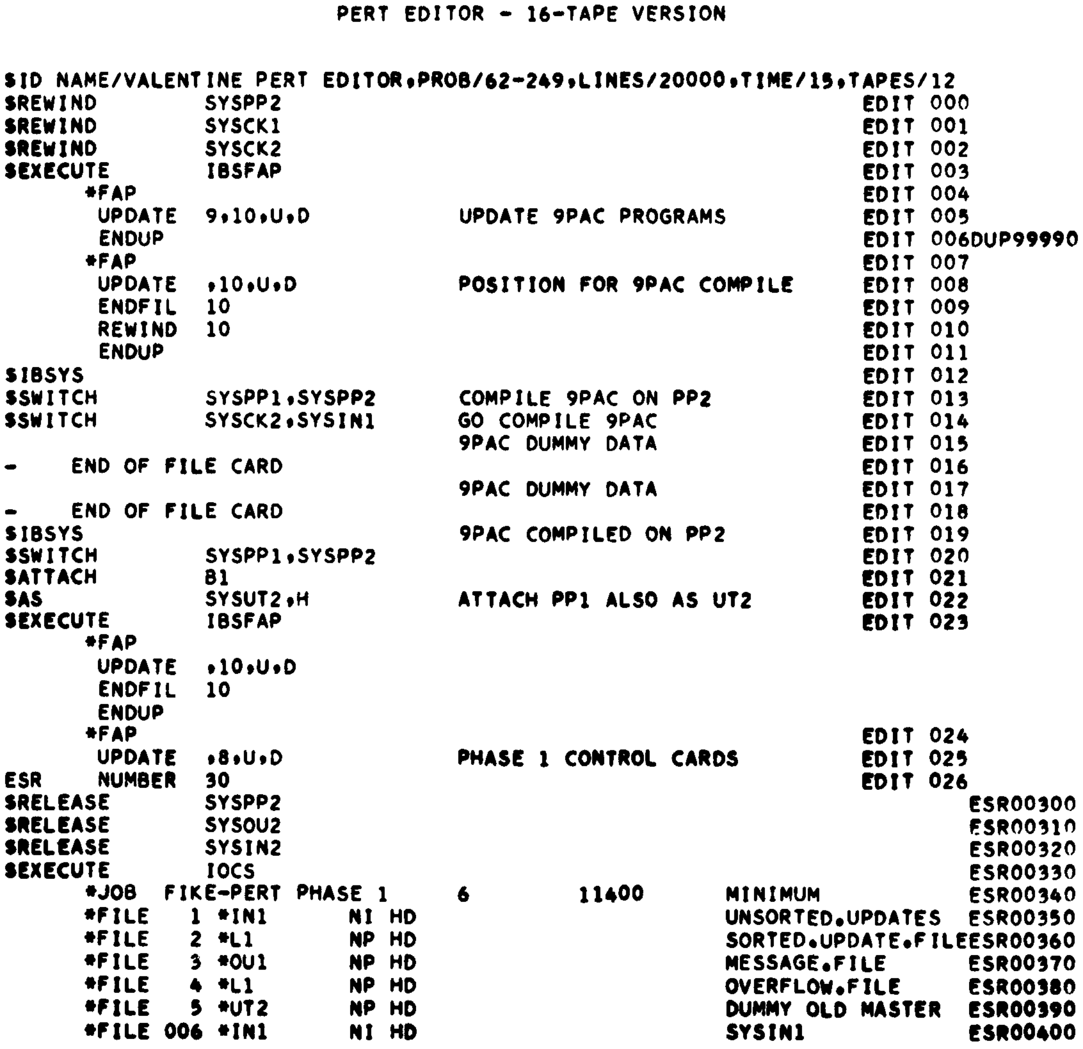
To simplify correcting and changing the PERT system, symbolic cards will be distributed to users with a modification letter indicating the section requiring the changes. The user can then obtain a new object program by using the PERT editor deck.

F. Program Listing - PERT Editor (16-Tape Version)

The program listing of the PERT editor for the 16-tape version is shown in Figures V-1a through V-1j, commencing on the following page.

G. Program Listing - PERT Editor (12-Tape Version)

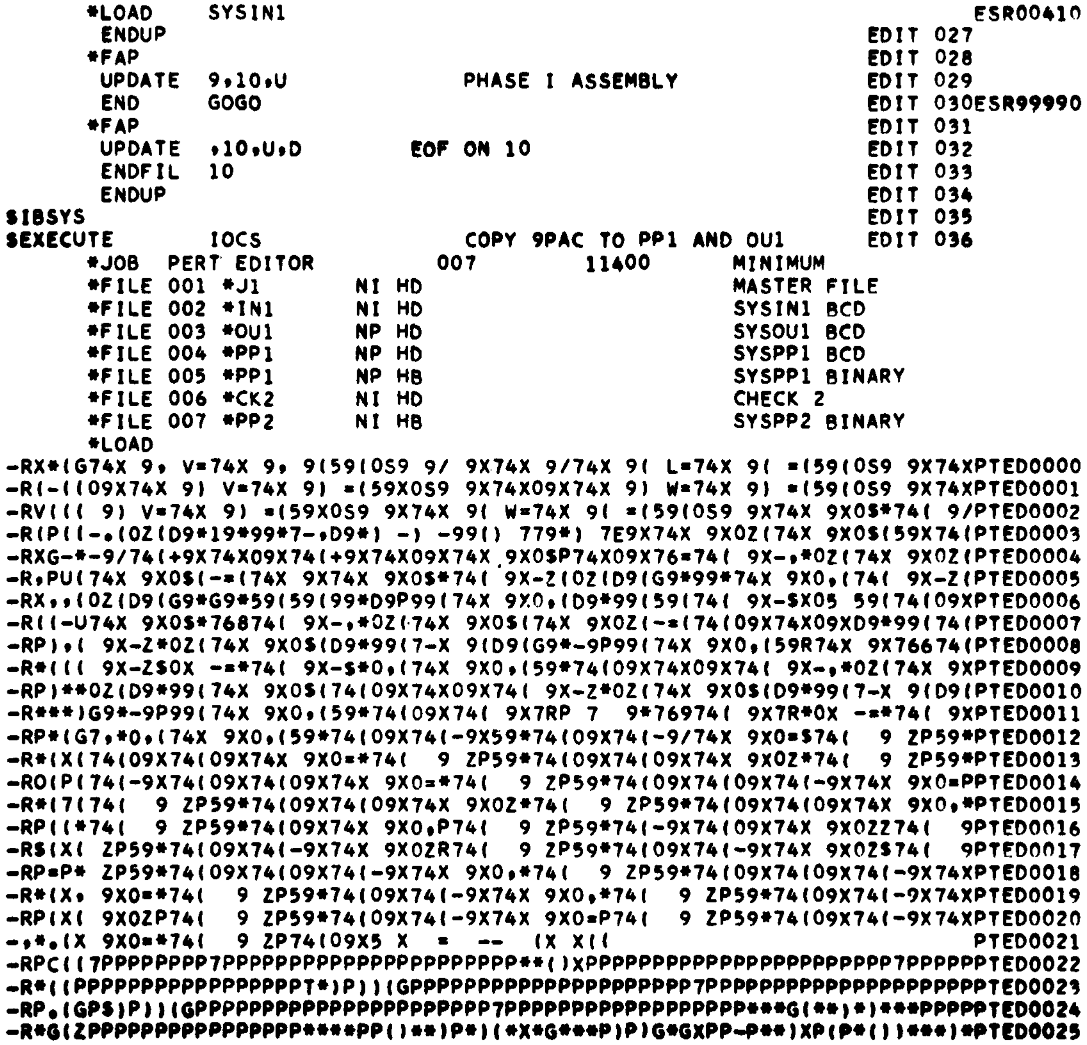
The program listing of the PERT editor for the 12-tape version is shown in Figures V-2a through V-2i, commencing on page V-17.



```
                         PERT EDITOR - 16-TAPE VERSION

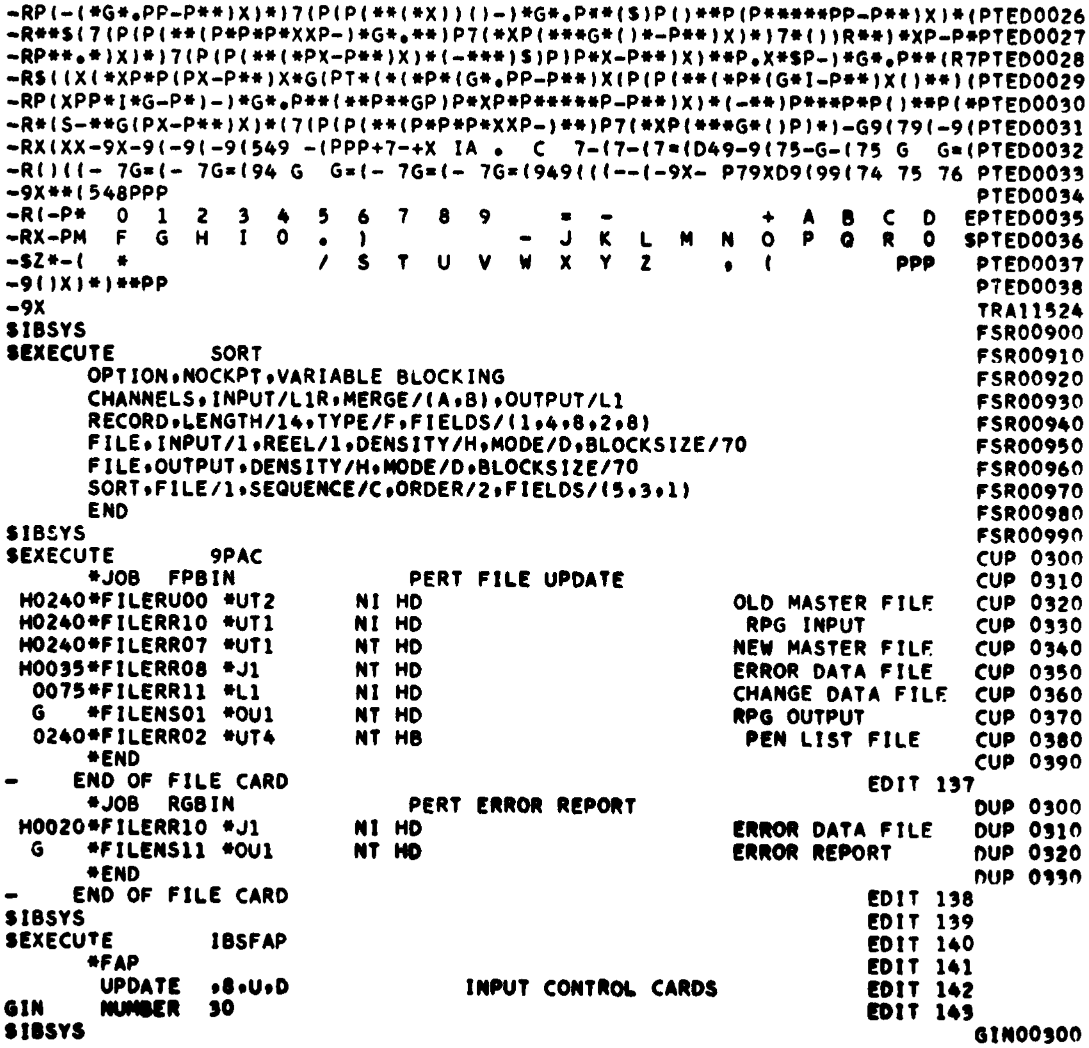
$ID NAME/VALENTINE PERT EDITOR,PROB/62-249,LINES/20000,TIME/15,TAPES/12
$REWIND        SYSPP2                                           EDIT 000
$REWIND        SYSCK1                                           EDIT 001
$REWIND        SYSCK2                                           EDIT 002
$EXECUTE       IBSFAP                                           EDIT 003
      *FAP                                                      EDIT 004
       UPDATE  9,10,U,D           UPDATE 9PAC PROGRAMS          EDIT 005
       ENDUP                                                    EDIT 006DUP99990
      *FAP                                                      EDIT 007
       UPDATE  ,10,U,D            POSITION FOR 9PAC COMPILE     EDIT 008
       ENDFIL  10                                               EDIT 009
       REWIND  10                                               EDIT 010
       ENDUP                                                    EDIT 011
$IBSYS                                                          EDIT 012
$SWITCH        SYSPP1,SYSPP2      COMPILE 9PAC ON PP2           EDIT 013
$SWITCH        SYSCK2,SYSIN1      GO COMPILE 9PAC               EDIT 014
                                  9PAC DUMMY DATA               EDIT 015
-    END OF FILE CARD                                           EDIT 016
                                  9PAC DUMMY DATA               EDIT 017
-    END OF FILE CARD                                           EDIT 018
$IBSYS                            9PAC COMPILED ON PP2          EDIT 019
$SWITCH        SYSPP1,SYSPP2                                    EDIT 020
$ATTACH        B1                                               EDIT 021
$AS            SYSUT2,H           ATTACH PP1 ALSO AS UT2        EDIT 022
$EXECUTE       IBSFAP                                           EDIT 023
      *FAP
       UPDATE  ,10,U,D
       ENDFIL  10
       ENDUP
      *FAP                                                      EDIT 024
       UPDATE  ,8,U,D             PHASE 1 CONTROL CARDS         EDIT 025
ESR    NUMBER  30                                               EDIT 026
$RELEASE       SYSPP2                                                   ESR00300
$RELEASE       SYSOU2                                                   ESR00310
$RELEASE       SYSIN2                                                   ESR00320
$EXECUTE       IOCS                                                     ESR00330
      *JOB  FIKE-PERT PHASE 1     6        11400      MINIMUM           ESR00340
      *FILE   1 *IN1      NI HD                       UNSORTED.UPDATES  ESR00350
      *FILE   2 *L1       NP HD                       SORTED.UPDATE.FILEESR00360
      *FILE   3 *OU1      NP HD                       MESSAGE.FILE      ESR00370
      *FILE   4 *L1       NP HD                       OVERFLOW.FILE     ESR00380
      *FILE   5 *UT2      NP HD                       DUMMY OLD MASTER  ESR00390
      *FILE 006 *IN1      NI HD                       SYSIN1            ESR00400
```

Figure V-1a
PERT Editor (16-Tape Version)



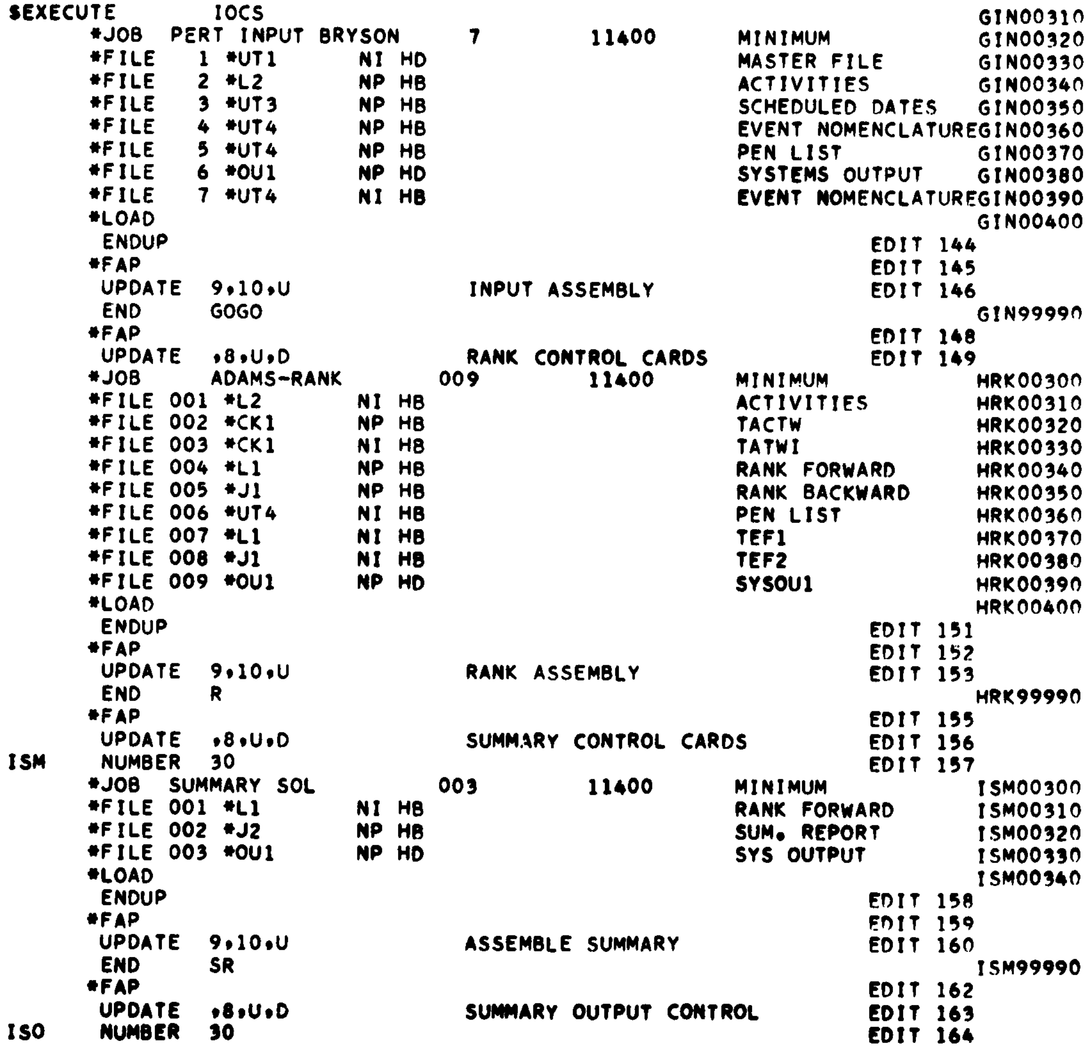
```
      *LOAD    SYSIN1                                                      ESR00410
       ENDUP                                                        EDIT 027
      *FAP                                                          EDIT 028
       UPDATE  9,10,U            PHASE I ASSEMBLY                   EDIT 029
       END     GOGO                                                 EDIT 030ESR99990
      *FAP                                                          EDIT 031
       UPDATE  ,10,U,D        EOF ON 10                             EDIT 032
       ENDFIL  10                                                   EDIT 033
       ENDUP                                                        EDIT 034
$IBSYS                                                              EDIT 035
$EXECUTE        IOCS             COPY 9PAC TO PP1 AND OU1           EDIT 036
      *JOB  PERT EDITOR            007        11400       MINIMUM
      *FILE 001 *J1        NI HD                          MASTER FILE
      *FILE 002 *IN1       NI HD                          SYSIN1 BCD
      *FILE 003 *OU1       NP HD                          SYSOU1 BCD
      *FILE 004 *PP1       NP HD                          SYSPP1 BCD
      *FILE 005 *PP1       NP HB                          SYSPP1 BINARY
      *FILE 006 *CK2       NI HD                          CHECK 2
      *FILE 007 *PP2       NI HB                          SYSPP2 BINARY
      *LOAD
-RX*(G74X 9, V=74X 9, 9(59(0S9 9/ 9X74X 9/74X 9( L=74X 9( =(59(0S9 9X74XPTED0000
-R(-((09X74X 9) V=74X 9) =(59X0S9 9X74X09X74X 9) W=74X 9) =(59(0S9 9X74XPTED0001
-RV((( 9) V=74X 9) =(59X0S9 9X74X 9( W=74X 9( =(59(0S9 9X74X 9X0$*74( 9/PTED0002
-R(P((-.(0Z(D9*19*99*7-,D9*) -) -99() 779*) 7E9X74X 9X0Z(74X 9X0$(59X74(PTED0003
-RXG-*-9/74(+9X74X09X74(+9X74X09X74X 9X0$P74X09X76=74( 9X-,*0Z(74X 9X0Z(PTED0004
-R,PU(74X 9X0$(-=(74X 9X74X 9X0$*74( 9X-Z(0Z(D9(G9*99*74X 9X0,(74( 9X-Z(PTED0005
-RX,,(0Z(D9(G9*G9*59(59(99*D9P99(74X 9X0,(D9*99(59(74( 9X-$X05 59(74(09XPTED0006
-R((-U74X 9X0$*76874( 9X-,*0Z(74X 9X0$(74X 9X0Z(-=(74(09X74X09XD9*99(74(PTED0007
-RP),( 9X-Z*0Z(74X 9X0$(D9*99(7-X 9(D9(G9*-9P99(74X 9X0,(59R74X 9X76674(PTED0008
-R*((( 9X-Z$0X -=*74( 9X-$*0,(74X 9X0,(59*74(09X74X09X74( 9X-,*0Z(74X 9XPTED0009
-RP)**0Z(D9*99(74X 9X0$(74(09X74X09X74( 9X-Z*0Z(74X 9X0$(D9*99(7-X 9(D9(PTED0010
-R***)G9*-9P99(74X 9X0,(59*74(09X74( 9X7RP 7  9*76974( 9X7R*0X -=*74( 9XPTED0011
-RP*(G7,*0,(74X 9X0,(59*74(09X74(-9X59*74(09X74(-9/74X 9X0=$74(  9 ZP59*PTED0012
-R*(X(74(09X74(09X74X 9X0=*74(  9 ZP59*74(09X74(09X74X 9X0Z*74(  9 ZP59*PTED0013
-RO(P(74(-9X74(09X74(09X74X 9X0=*74(  9 ZP59*74(09X74(09X74(-9X74X 9X0=PPTED0014
-R*(7(74(  9 ZP59*74(09X74(09X74X 9X0Z*74(  9 ZP59*74(09X74(09X74X 9X0,*PTED0015
-RP((*74(  9 ZP59*74(09X74X 9X0,P74(  9 ZP59*74(-9X74(09X74X 9X0Z74(  9PTED0016
-R$(X( ZP59*74(09X74(-9X74X 9X0ZR74(  9 ZP59*74(09X74(-9X74X 9X0Z$74(  9PTED0017
-RP=P* ZP59*74(09X74(09X74(-9X74X 9X0,*74(  9 ZP59*74(09X74(09X74(-9X74XPTED0018
-R*(X, 9X0=*74(  9 ZP59*74(09X74(-9X74X 9X0,*74(  9 ZP59*74(09X74(-9X74XPTED0019
-RP(X( 9X0ZP74(  9 ZP59*74(09X74(-9X74X 9X0=P74(  9 ZP59*74(09X74(-9X74XPTED0020
-,*.(X 9X0=*74(  9 ZP74(09X5 X  =  --  (X X((                          PTED0021
-RPC((7PPPPPPPP7PPPPPPPPPPPPPPPPPPPPPP**()XPPPPPPPPPPPPPPPPPPPPPPP7PPPPPPTED0022
-R*((PPPPPPPPPPPPPPPPT*)P))(GPPPPPPPPPPPPPPPPPPPPPPPPPP7PPPPPPPPPPPPPPPPPTED0023
-RP.(GP$)P))(GPPPPPPPPPPPPPPPPPPPPPP7PPPPPPPPPPPPPPPPPPP**G(**)*)***PPPPPTED0024
-R*G(ZPPPPPPPPPPPPPPPP****PP()**)P*)(*X*G***P)P)G*GXPP-P**)XP(P*())***)*PTED0025
```

Figure V-1b
PERT Editor (16-Tape Version)



```
-RP(-(*G*,PP-P**)X)*)7(P(P(**(*X))()-)*G*,P**($)P()**P(P*****PP-P**)X)*(PTED0026
-R**$(7(P(P(**(P*P*P*XXP-)*G*,**)P7(*XP(***G*()*-P**)X)*)7*())R**)*XP-P*PTED0027
-RP**,*)X)*)7(P(P(**(*PX-P**)X)*(-***)$)P)P*X-P**)X)**P,X*$P-)*G*,P**(R7PTED0028
-R$((X(*XP*P(PX-P**)X*G(PT*(*(*P*(G*,PP-P**)X(P(P(**(*P*(G*I-P**)X()**)(PTED0029
-RP(XPP*I*G-P*)-)*G*,P**(**P**GP)P*XP*P*****P-P**)X)*(-**)P***P*P()**P(*PTED0030
-R*(S-**G(PX-P**)X)*(7(P(P(**(P*P*P*XXP-)**)P7(*XP(***G*()P)*)-G9(79(-9(PTED0031
-RX(XX-9X-9(-9(-9(549 -(PPP+7-+X IA ,  C  7-(7-(7=(D49-9(75-G-(75 G  G=(PTED0032
-R()((- 7G=(- 7G=(94 G  G=(- 7G=(- 7G=(949(((--(-9X- P79XD9(99(74 75 76 PTED0033
-9X**(548PPP                                                             PTED0034
-R(-P*  0  1  2  3  4  5  6  7  8  9     =  -           +  A  B  C  D  EPTED0035
-RX-PM  F  G  H  I  0  ,  )           -  J  K  L  M  N  O  P  Q  R  0  $PTED0036
-$Z*-(  *              /  S  T  U  V  W  X  Y  Z     ,  (          PPP   PTED0037
-9()X)*)**PP                                                             PTED0038
-9X                                                                      TRA11524
$IBSYS                                                                   FSR00900
$EXECUTE       SORT                                                      FSR00910
      OPTION,NOCKPT,VARIABLE BLOCKING                                    FSR00920
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1                           FSR00930
      RECORD,LENGTH/14,TYPE/F,FIELDS/(1,4,8,2,8)                         FSR00940
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/D,BLOCKSIZE/70                  FSR00950
      FILE,OUTPUT,DENSITY/H,MODE/D,BLOCKSIZE/70                          FSR00960
      SORT,FILE/1,SEQUENCE/C,ORDER/2,FIELDS/(5,3,1)                      FSR00970
      END                                                                FSR00980
$IBSYS                                                                   FSR00990
$EXECUTE       9PAC                                                      CUP 0300
      *JOB  FPBIN             PERT FILE UPDATE                           CUP 0310
 H0240*FILERU00 *UT2      NI HD                   OLD MASTER FILE        CUP 0320
 H0240*FILERR10 *UT1      NI HD                    RPG INPUT             CUP 0330
 H0240*FILERR07 *UT1      NT HD                   NEW MASTER FILE        CUP 0340
 H0035*FILERR08 *J1       NT HD                   ERROR DATA FILE        CUP 0350
  0075*FILERR11 *L1       NI HD                   CHANGE DATA FILE       CUP 0360
  G    *FILENS01 *OU1     NT HD                   RPG OUTPUT             CUP 0370
  0240*FILERR02 *UT4      NT HB                    PEN LIST FILE         CUP 0380
      *END                                                               CUP 0390
-    END OF FILE CARD                                           EDIT 137
      *JOB  RGBIN             PERT ERROR REPORT                          DUP 0300
 H0020*FILERR10 *J1       NI HD                   ERROR DATA FILE        DUP 0310
  G    *FILENS11 *OU1     NT HD                   ERROR REPORT           DUP 0320
      *END                                                               DUP 0330
-    END OF FILE CARD                                           EDIT 138
$IBSYS                                                          EDIT 139
$EXECUTE       IBSFAP                                           EDIT 140
      *FAP                                                      EDIT 141
       UPDATE   ,8,U,D              INPUT CONTROL CARDS         EDIT 142
GIN    NUMBER   30                                              EDIT 143
$IBSYS                                                                   GIN00300
```

Figure V-1c
PERT Editor (16-Tape Version)

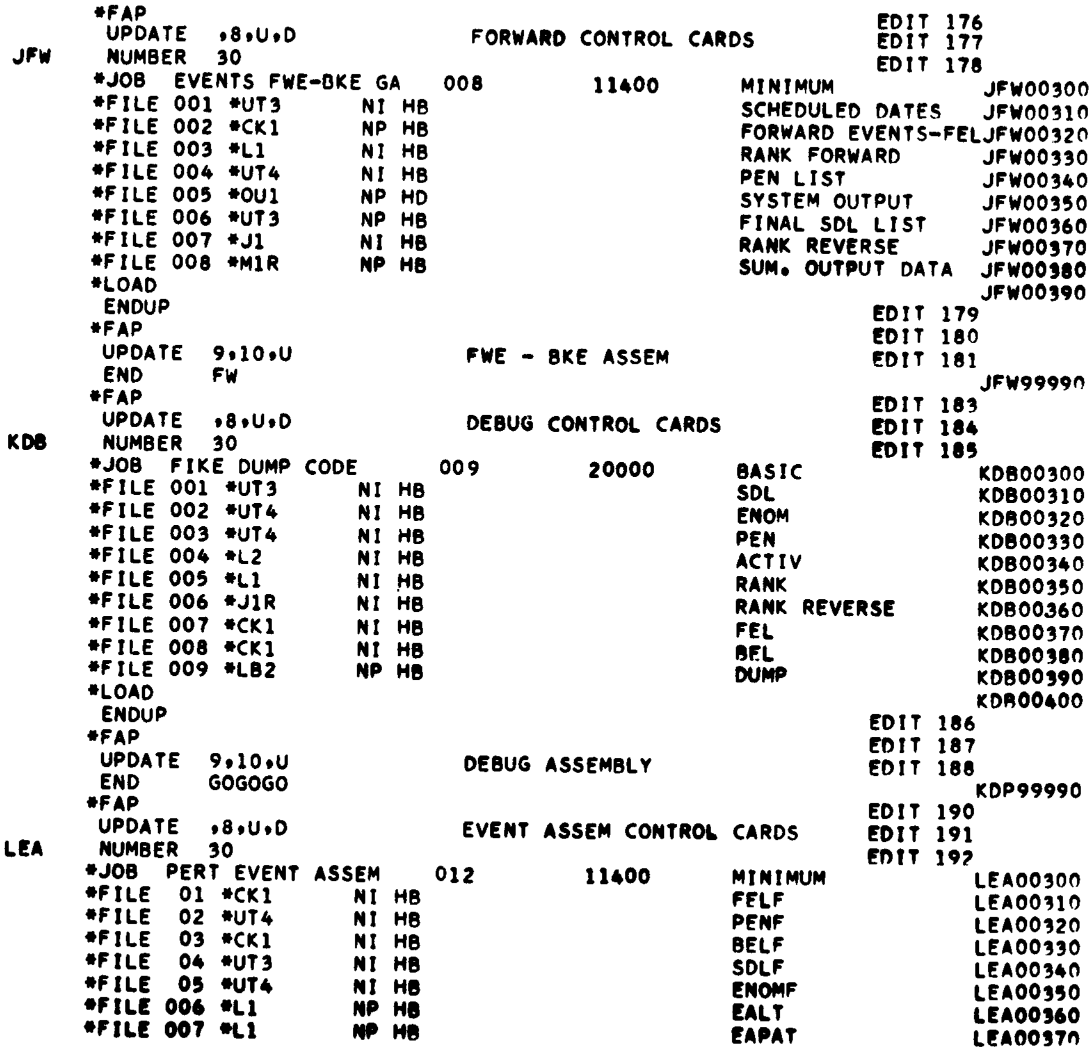


```
$EXECUTE       IOCS                                                      GIN00310
      *JOB  PERT INPUT BRYSON      7        11400      MINIMUM           GIN00320
      *FILE   1 *UT1      NI HD                        MASTER FILE       GIN00330
      *FILE   2 *L2       NP HB                        ACTIVITIES        GIN00340
      *FILE   3 *UT3      NP HB                        SCHEDULED DATES   GIN00350
      *FILE   4 *UT4      NP HB                        EVENT NOMENCLATUREGIN00360
      *FILE   5 *UT4      NP HB                        PEN LIST          GIN00370
      *FILE   6 *OU1      NP HD                        SYSTEMS OUTPUT    GIN00380
      *FILE   7 *UT4      NI HB                        EVENT NOMENCLATUREGIN00390
      *LOAD                                                              GIN00400
       ENDUP                                                     EDIT 144
      *FAP                                                       EDIT 145
       UPDATE  9,10,U              INPUT ASSEMBLY                EDIT 146
       END     GOGO                                                      GIN99990
      *FAP                                                       EDIT 148
       UPDATE  ,8,U,D              RANK CONTROL CARDS            EDIT 149
      *JOB     ADAMS-RANK       009         11400      MINIMUM           HRK00300
      *FILE 001 *L2       NI HB                        ACTIVITIES        HRK00310
      *FILE 002 *CK1      NP HB                        TACTW             HRK00320
      *FILE 003 *CK1      NI HB                        TATWI             HRK00330
      *FILE 004 *L1       NP HB                        RANK FORWARD      HRK00340
      *FILE 005 *J1       NP HB                        RANK BACKWARD     HRK00350
      *FILE 006 *UT4      NI HB                        PEN LIST          HRK00360
      *FILE 007 *L1       NI HB                        TEF1              HRK00370
      *FILE 008 *J1       NI HB                        TEF2              HRK00380
      *FILE 009 *OU1      NP HD                        SYSOU1            HRK00390
      *LOAD                                                              HRK00400
       ENDUP                                                     EDIT 151
      *FAP                                                       EDIT 152
       UPDATE  9,10,U              RANK ASSEMBLY                 EDIT 153
       END     R                                                         HRK99990
      *FAP                                                       EDIT 155
       UPDATE  ,8,U,D              SUMMARY CONTROL CARDS         EDIT 156
ISM    NUMBER  30                                                EDIT 157
      *JOB  SUMMARY SOL         003         11400      MINIMUM           ISM00300
      *FILE 001 *L1       NI HB                        RANK FORWARD      ISM00310
      *FILE 002 *J2       NP HB                        SUM. REPORT       ISM00320
      *FILE 003 *OU1      NP HD                        SYS OUTPUT        ISM00330
      *LOAD                                                              ISM00340
       ENDUP                                                     EDIT 158
      *FAP                                                       EDIT 159
       UPDATE  9,10,U              ASSEMBLE SUMMARY              EDIT 160
       END     SR                                                        ISM99990
      *FAP                                                       EDIT 162
       UPDATE  ,8,U,D              SUMMARY OUTPUT CONTROL        EDIT 163
ISO    NUMBER  30                                                EDIT 164
```

Figure V-1d
PERT Editor (16-Tape Version)

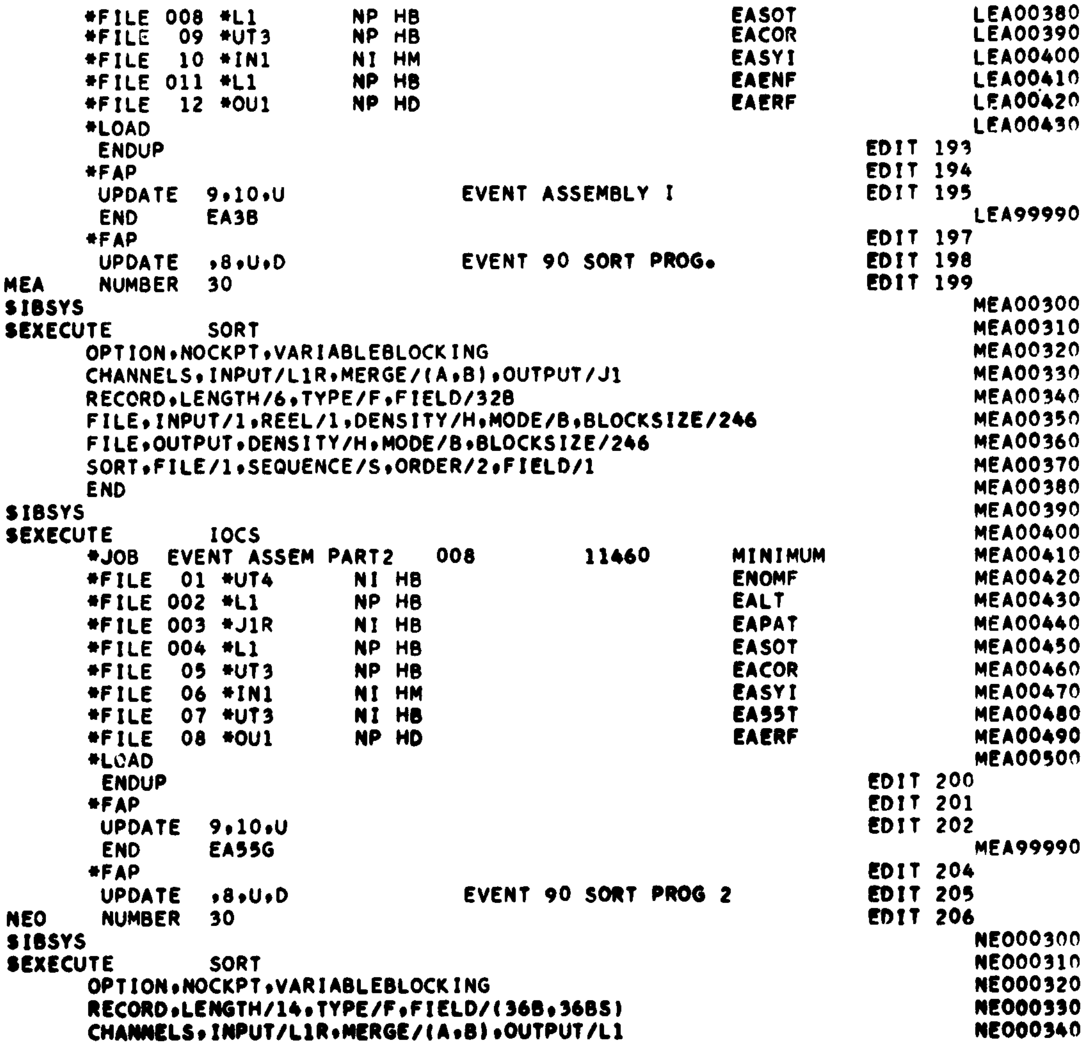
```
      *JOB  PART I SUM OUTPUT   009        11400      MINIMUM          IS000300
      *FILE 001 *UT4      NI HB                       TITLES PEN L      IS000310
      *FILE 002 *UT3      NI HB                       SDL LIST          IS000320
      *FILE 003 *UT3      NP HB                        PAR OUT          IS000330
      *FILE 004 *J2R      NI HB                       SUMMARY REPORT    IS000340
      *FILE 005 *M1       NP HB                       1/3/6-CODES OUT   IS000350
      *FILE 006 *M1       NI HB                       1/3/6-CODES IN    IS000360
      *FILE 007 *IN1      NI HM                       SYS INPUT         IS000370
      *FILE 008 *PP1      NP HD                       CARD OUTPUT       IS000380
      *FILE 009 *OU1      NP HD                       SYS OUTPUT        IS000390
      *LOAD                                                             IS000400
       ENDUP                                                    EDIT 165
      *FAP                                                      EDIT 166
       UPDATE  9,10,U             SUMMARY OUTPUT ASSEM          EDIT 167
       END     SX                                                       IS099990
      *FAP                                                      EDIT 169
       UPDATE  ,8,U,D             90 SORT AND SXX               EDIT 170
ISP    NUMBER  30                                               EDIT 171
$IBSYS                                                                  ISP00300
$* REMOVE B5, REPLACE WITH A BLANK TAPE.                                ISP00310
$PAUSE                                                                  ISP00320
$RELEASE       SYSUT2                                                   ISP00330
$RELEASE       SYSCK1                                                   ISP00340
$EXECUTE       SORT                                                     ISP00350
      OPTION,NOCKPT,VARIABLE BLOCKING                                   ISP00360
      CHANNELS,INPUT/M1R,MERGE/(A,B),OUTPUT/M1                          ISP00370
      RECORD,LENGTH/8,TYPE/F,FIELD/32B                                  ISP00380
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/248                ISP00390
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/248                        ISP00400
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/1                            ISP00410
      END                                                               ISP00420
$IBSYS                                                                  ISP00430
$ATTACH        A7                                                       ISP00440
$AS            SYSCK1                                                   ISP00450
$EXECUTE       IOCS                                                     ISP00460
      *JOB  PART II SUM OUTPUT  005        11400      MINIMUM          ISP00470
      *FILE 001 *M1R      NI HB                       SORTED DATA       ISP00480
      *FILE 002 *UT4      NI HB                       TITLES PEN L      ISP00490
      *FILE 003 *UT3      NI HB                       PAR (SDL)         ISP00500
      *FILE 004 *PP1      NP HD                       CARD OUTPUT       ISP00510
      *FILE 005 *OU1      NP HD                       SYS OUTPUT        ISP00520
      *LOAD                                                             ISP00530
       ENDUP                                                    EDIT 172
      *FAP                                                      EDIT 173
       UPDATE  9,10,U             SXX ASSEMBLY                  EDIT 174
       END     SXX1                                                     ISP99990
```

Figure V-1e
PERT Editor (16-Tape Version)



```
       *FAP                                                      EDIT 176
        UPDATE  ,8,U,D             FORWARD CONTROL CARDS         EDIT 177
JFW     NUMBER  30                                               EDIT 178
       *JOB  EVENTS FWE-BKE GA   008        11400      MINIMUM           JFW00300
       *FILE 001 *UT3      NI HB                       SCHEDULED DATES   JFW00310
       *FILE 002 *CK1      NP HB                       FORWARD EVENTS-FELJFW00320
       *FILE 003 *L1       NI HB                       RANK FORWARD      JFW00330
       *FILE 004 *UT4      NI HB                       PEN LIST          JFW00340
       *FILE 005 *OU1      NP HD                       SYSTEM OUTPUT     JFW00350
       *FILE 006 *UT3      NP HB                       FINAL SDL LIST    JFW00360
       *FILE 007 *J1       NI HB                       RANK REVERSE      JFW00370
       *FILE 008 *M1R      NP HB                       SUM. OUTPUT DATA  JFW00380
       *LOAD                                                             JFW00390
        ENDUP                                                    EDIT 179
       *FAP                                                      EDIT 180
        UPDATE  9,10,U             FWE - BKE ASSEM               EDIT 181
        END     FW                                                       JFW99990
       *FAP                                                      EDIT 183
        UPDATE  ,8,U,D             DEBUG CONTROL CARDS           EDIT 184
KDB     NUMBER  30                                               EDIT 185
       *JOB  FIKE DUMP CODE      009        20000      BASIC             KDB00300
       *FILE 001 *UT3      NI HB                       SDL               KDB00310
       *FILE 002 *UT4      NI HB                       ENOM              KDB00320
       *FILE 003 *UT4      NI HB                       PEN               KDB00330
       *FILE 004 *L2       NI HB                       ACTIV             KDB00340
       *FILE 005 *L1       NI HB                       RANK              KDB00350
       *FILE 006 *J1R      NI HB                       RANK REVERSE      KDB00360
       *FILE 007 *CK1      NI HB                       FEL               KDB00370
       *FILE 008 *CK1      NI HB                       BEL               KDB00380
       *FILE 009 *LB2      NP HB                       DUMP              KDB00390
       *LOAD                                                             KDB00400
        ENDUP                                                    EDIT 186
       *FAP                                                      EDIT 187
        UPDATE  9,10,U             DEBUG ASSEMBLY                EDIT 188
        END     GOGOGO                                                   KDP99990
       *FAP                                                      EDIT 190
        UPDATE  ,8,U,D             EVENT ASSEM CONTROL CARDS     EDIT 191
LEA     NUMBER  30                                               EDIT 192
       *JOB  PERT EVENT ASSEM    012        11400      MINIMUM           LEA00300
       *FILE  01 *CK1      NI HB                       FELF              LEA00310
       *FILE  02 *UT4      NI HB                       PENF              LEA00320
       *FILE  03 *CK1      NI HB                       BELF              LEA00330
       *FILE  04 *UT3      NI HB                       SDLF              LEA00340
       *FILE  05 *UT4      NI HB                       ENOMF             LEA00350
       *FILE 006 *L1       NP HB                       EALT              LEA00360
       *FILE 007 *L1       NP HB                       EAPAT             LEA00370
```

Figure V-1f
PERT Editor (16-Tape Version)

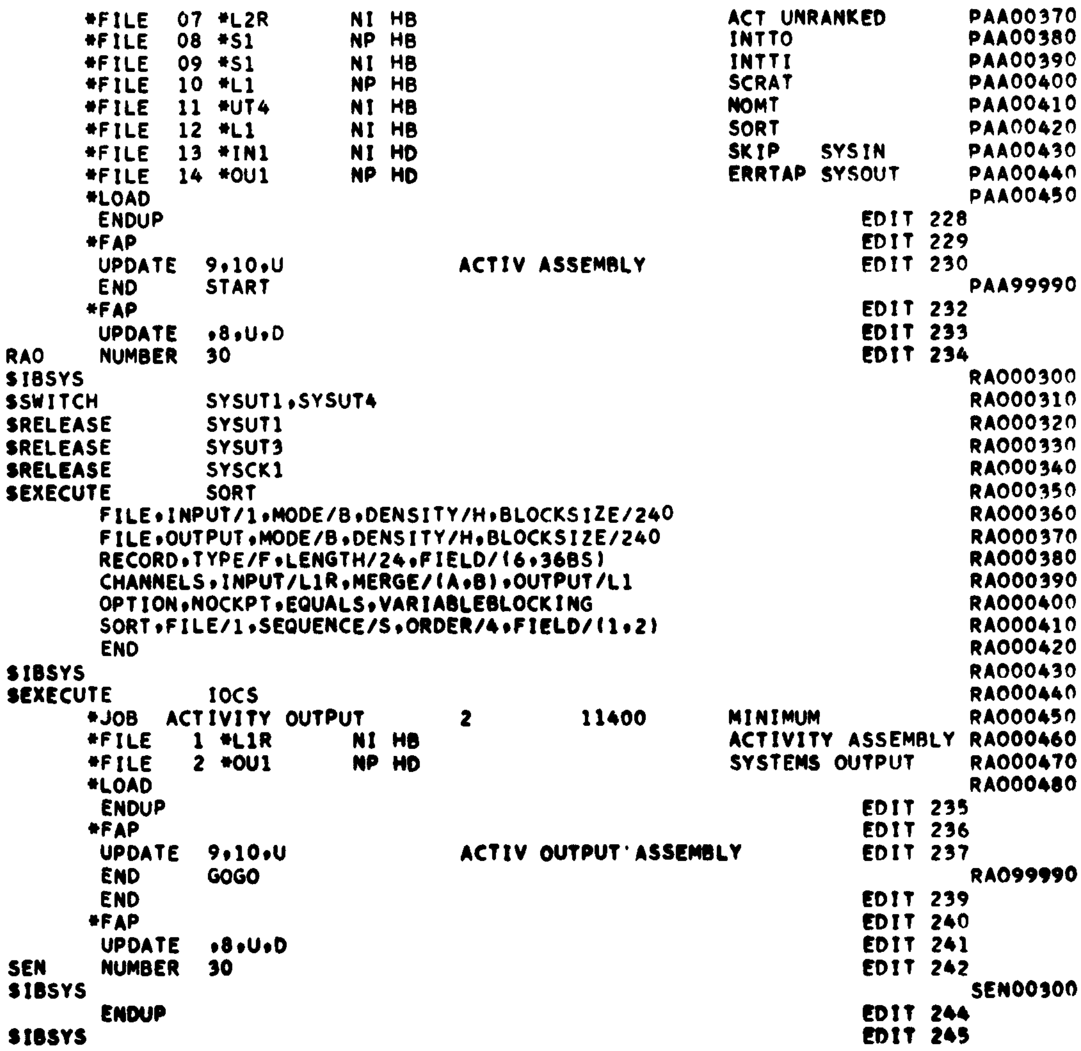


```
       *FILE 008 *L1         NP HB                               EASOT                LEA00380
       *FILE  09 *UT3        NP HB                               EACOR                LEA00390
       *FILE  10 *IN1        NI HM                               EASYI                LEA00400
       *FILE 011 *L1         NP HB                               EAENF                LEA00410
       *FILE  12 *OU1        NP HD                               EAERF                LEA00420
       *LOAD                                                                          LEA00430
        ENDUP                                                             EDIT 193
       *FAP                                                               EDIT 194
        UPDATE  9,10,U                 EVENT ASSEMBLY I                   EDIT 195
        END     EA3B                                                              LEA99990
       *FAP                                                               EDIT 197
        UPDATE  ,8,U,D                 EVENT 90 SORT PROG.                EDIT 198
MEA     NUMBER  30                                                        EDIT 199
$IBSYS                                                                            MEA00300
$EXECUTE        SORT                                                              MEA00310
       OPTION,NOCKPT,VARIABLEBLOCKING                                             MEA00320
       CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/J1                                   MEA00330
       RECORD,LENGTH/6,TYPE/F,FIELD/32B                                           MEA00340
       FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/246                         MEA00350
       FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/246                                 MEA00360
       SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/1                                     MEA00370
       END                                                                        MEA00380
$IBSYS                                                                            MEA00390
$EXECUTE        IOCS                                                              MEA00400
       *JOB  EVENT ASSEM PART2   008         11460       MINIMUM                  MEA00410
       *FILE  01 *UT4        NI HB                               ENOMF                MEA00420
       *FILE 002 *L1         NP HB                               EALT                 MEA00430
       *FILE 003 *J1R        NI HB                               EAPAT                MEA00440
       *FILE 004 *L1         NP HB                               EASOT                MEA00450
       *FILE  05 *UT3        NP HB                               EACOR                MEA00460
       *FILE  06 *IN1        NI HM                               EASYI                MEA00470
       *FILE  07 *UT3        NI HB                               EA55T                MEA00480
       *FILE  08 *OU1        NP HD                               EAERF                MEA00490
       *LOAD                                                                          MEA00500
        ENDUP                                                             EDIT 200
       *FAP                                                               EDIT 201
        UPDATE  9,10,U                                                    EDIT 202
        END     EA55G                                                             MEA99990
       *FAP                                                               EDIT 204
        UPDATE  ,8,U,D                 EVENT 90 SORT PROG 2               EDIT 205
NEO     NUMBER  30                                                        EDIT 206
$IBSYS                                                                            NEO00300
$EXECUTE        SORT                                                              NEO00310
       OPTION,NOCKPT,VARIABLEBLOCKING                                             NEO00320
       RECORD,LENGTH/14,TYPE/F,FIELD/(36B,36BS)                                   NEO00330
       CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1                                   NEO00340
```

Figure V-1g
PERT Editor (16-Tape Version)

```
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/238                NE000350
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/238                         NE000360
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/(1,2)                         NE000370
      END                                                                NE000380
$IBSYS                                                                   NE000390
$EXECUTE       IOCS                                                      NE000400
      *JOB  EVENT PRINTOUT       002        11400      MINIMUM           NE000410
      *FILE 001 *L1       NI HB                        EVENT ASSEMBLY    NE000420
      *FILE 002 *OU1      NP HD                        SYSOU1            NE000430
      *LOAD                                                              NE000440
       ENDUP                                                     EDIT 207
      *FAP                                                       EDIT 208
       UPDATE  9,10,U              EVENT OUTPUT ASSEMBLY         EDIT 209
       END     XEV                                                       NE099990
      *FAP                                                       EDIT 211
       UPDATE  ,8,U,D              EL CHART CONTROL              EDIT 212
OEL    NUMBER  30                                                EDIT 213
      *JOB  E-L CHART            002        11400      MINIMUM           OEL00300
      *FILE 001 *L1       NI HB                        EVENT ASSEMBLY    OEL00310
      *FILE 002 *OU1      NP HD                        SYSOU1            OEL00320
      *LOAD                                                              OEL00330
       ENDUP                                                     EDIT 214
      *FAP                                                       EDIT 215
       UPDATE  9,10,U              EL CHART ASSEMBLY             EDIT 216
       END     EL                                                        OEL99990
      *FAP                                                       EDIT 218
       UPDATE  ,8,U,D              EL MO. CHART CONTROL CARDS    EDIT 219
OEM    NUMBER  30                                                EDIT 220
      *JOB  E-L MONTH CHART      002        11400      MINIMUM           OEM00300
      *FILE 001 *L1       NI HB                        EVENT ASSEMBLY    OEM00310
      *FILE 002 *OU1      NP HD                         SYSOU1           OEM00320
      *LOAD                                                              OEM00330
       ENDUP                                                     EDIT 221
      *FAP                                                       EDIT 222
       UPDATE  9,10,U              EL MONTH CHART ASSEMBLY       EDIT 223
       END     M                                                         OEM99990
      *FAP                                                       EDIT 225
       UPDATE  ,8,U,D              ACTIVITY ASSEM CONTROL CARDS  EDIT 226
PAA    NUMBER  30                                                EDIT 227
      *JOB  ACTIVITY ASSEMBLY     14        11400      MINIMUM           PAA00300
      *FILE  01 *UT1      NI HD                        MASFIL            PAA00310
      *FILE  02 *L1       NP HB                        ACT ASSEMBLY TAPE PAA00320
      *FILE  03 *UT4      NI HB                        PENT              PAA00330
      *FILE  04 *UT3      NI HB                        SDLT              PAA00340
      *FILE  05 *CK1      NI HB                        FELT              PAA00350
      *FILE  06 *CK1      NI HB                        BELT              PAA00360
```

Figure V-1h
PERT Editor (16-Tape Version)



```
      *FILE  07 *L2R      NI HB                          ACT UNRANKED      PAA00370
      *FILE  08 *S1       NP HB                          INTTO             PAA00380
      *FILE  09 *S1       NI HB                          INTTI             PAA00390
      *FILE  10 *L1       NP HB                          SCRAT             PAA00400
      *FILE  11 *UT4      NI HB                          NOMT              PAA00410
      *FILE  12 *L1       NI HB                          SORT              PAA00420
      *FILE  13 *IN1      NI HD                          SKIP   SYSIN      PAA00430
      *FILE  14 *OU1      NP HD                          ERRTAP SYSOUT     PAA00440
      *LOAD                                                                PAA00450
       ENDUP                                                      EDIT 228
      *FAP                                                        EDIT 229
       UPDATE  9,10,U             ACTIV ASSEMBLY                  EDIT 230
       END     START                                                       PAA99990
      *FAP                                                        EDIT 232
       UPDATE  ,8,U,D                                             EDIT 233
RAO    NUMBER  30                                                 EDIT 234
$IBSYS                                                                     RAO00300
$SWITCH        SYSUT1,SYSUT4                                               RAO00310
$RELEASE       SYSUT1                                                      RAO00320
$RELEASE       SYSUT3                                                      RAO00330
$RELEASE       SYSCK1                                                      RAO00340
$EXECUTE       SORT                                                        RAO00350
       FILE,INPUT/1,MODE/B,DENSITY/H,BLOCKSIZE/240                         RAO00360
       FILE,OUTPUT,MODE/B,DENSITY/H,BLOCKSIZE/240                          RAO00370
       RECORD,TYPE/F,LENGTH/24,FIELD/(6,36BS)                              RAO00380
       CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1                            RAO00390
       OPTION,NOCKPT,EQUALS,VARIABLEBLOCKING                               RAO00400
       SORT,FILE/1,SEQUENCE/S,ORDER/4,FIELD/(1,2)                          RAO00410
       END                                                                 RAO00420
$IBSYS                                                                     RAO00430
$EXECUTE       IOCS                                                        RAO00440
      *JOB  ACTIVITY OUTPUT       2         11400        MINIMUM           RAO00450
      *FILE   1 *L1R      NI HB                          ACTIVITY ASSEMBLY RAO00460
      *FILE   2 *OU1      NP HD                          SYSTEMS OUTPUT    RAO00470
      *LOAD                                                                RAO00480
       ENDUP                                                      EDIT 235
      *FAP                                                        EDIT 236
       UPDATE  9,10,U             ACTIV OUTPUT ASSEMBLY           EDIT 237
       END     GOGO                                                        RAO99990
       END                                                        EDIT 239
      *FAP                                                        EDIT 240
       UPDATE  ,8,U,D                                             EDIT 241
SEN    NUMBER  30                                                 EDIT 242
$IBSYS                                                                     SEN00300
       ENDUP                                                      EDIT 244
$IBSYS                                                            EDIT 245
```

Figure V-1i
PERT Editor (16-Tape Version)

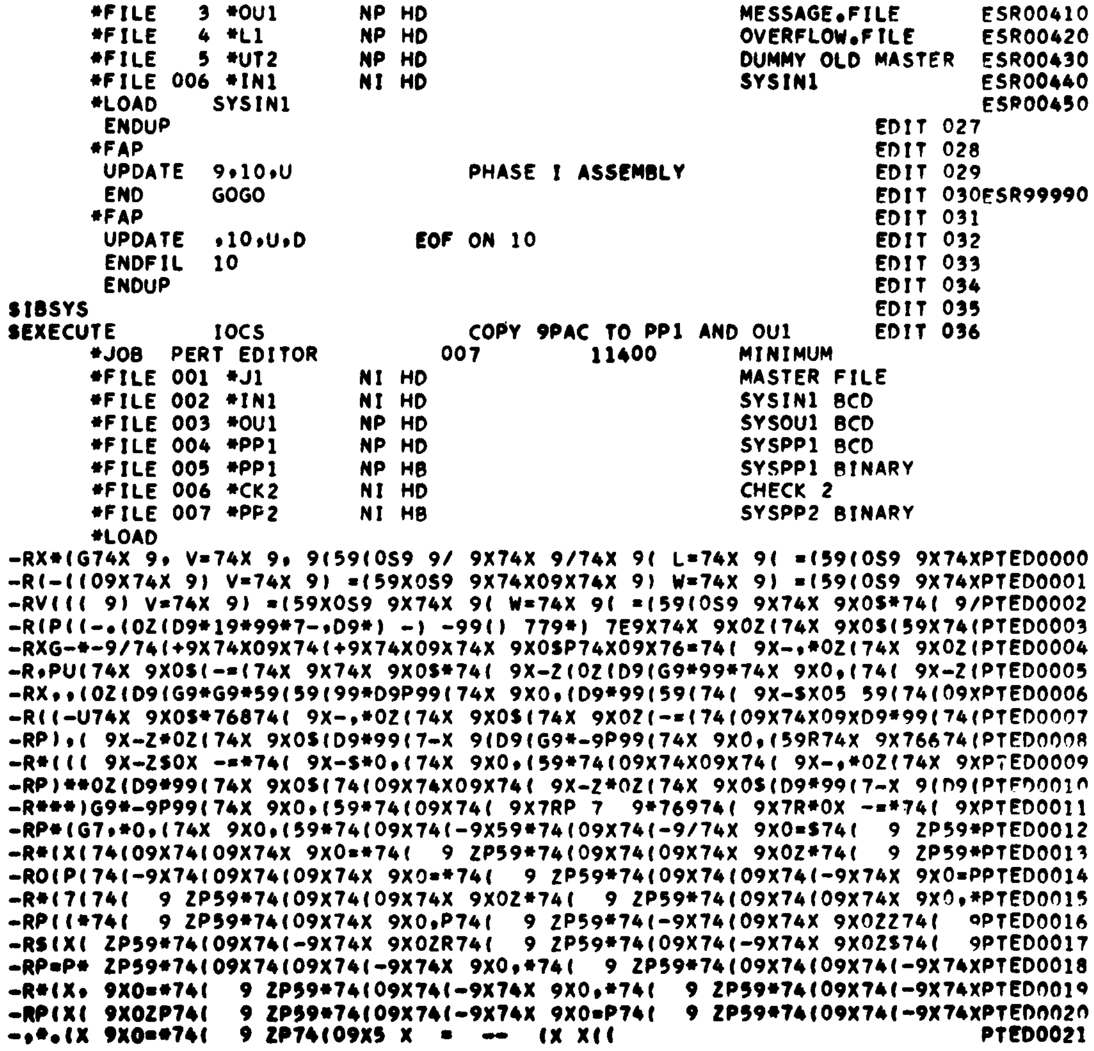
```
$REWIND         SYSCK1                                                   EDIT 246
$REMOVE         SYSCK1                                                   EDIT 247
$ENDFILE        SYSCK2                                                   EDIT 248
$REWIND         SYSCK2                                                   EDIT 249
$IBSYS                                                                   EDIT 250
```

Figure V-1j
PERT Editor (16-Tape Version)

```
                         PERT EDITOR - 12-TAPE VERSION

$ID NAME/VALENTINE PERT EDITOR,PROB/62-249,LINES/20000,TIME/15,TAPES/12
$REWIND        SYSPP2                                         EDIT 000
$REWIND        SYSCK1                                         EDIT 001
$REWIND        SYSCK2                                         EDIT 002
$EXECUTE       IBSFAP                                         EDIT 003
      *FAP                                                    EDIT 004
       UPDATE  9,10,U,D          UPDATE 9PAC PROGRAMS         EDIT 005
       ENDUP                                                  EDIT 006DUP99990
      *FAP                                                    EDIT 007
       UPDATE  ,10,U,D           POSITION FOR 9PAC COMPILE    EDIT 008
       ENDFIL  10                                             EDIT 009
       REWIND  10                                             EDIT 010
       ENDUP                                                  EDIT 011
$IBSYS                                                        EDIT 012
$SWITCH        SYSPP1,SYSPP2     COMPILE 9PAC ON PP2          EDIT 013
$SWITCH        SYSCK2,SYSIN1     GO COMPILE 9PAC              EDIT 014
                                 9PAC DUMMY DATA              EDIT 015
-    END OF FILE CARD                                         EDIT 016
                                 9PAC DUMMY DATA              EDIT 017
-    END OF FILE CARD                                         EDIT 018
$IBSYS                           9PAC COMPILED ON PP2         EDIT 019
$SWITCH        SYSPP1,SYSPP2                                  EDIT 020
$ATTACH        B1                                             EDIT 021
$AS            SYSUT2,H          ATTACH PP1 ALSO AS UT2       EDIT 022
$EXECUTE       IBSFAP                                         EDIT 023
      *FAP
       UPDATE  ,10,U,D
       ENDFIL  10
       ENDUP
      *FAP                                                    EDIT 024
       UPDATE  ,8,U,D            PHASE 1 CONTROL CARDS        EDIT 025
ESR    NUMBER  30                                             EDIT 026
$DETACH        B7                                                     ESR00300
$DETACH        A2                                                     ESR00310
$DETACH        B1                                                     ESR00320
$DETACH        A7                                                     ESR00330
$RELEASE       SYSPP2                                                 ESR00340
$RELEASE       SYSOU2                                                 ESR00350
$RELEASE       SYSIN2                                                 ESR00360
$EXECUTE       IOCS                                                   ESR00370
      *JOB  FIKE-PERT PHASE 1    6        11400     MINIMUM           ESR00380
      *FILE   1 *IN1      NI HD                     UNSORTED.UPDATES  ESR00390
      *FILE   2 *L1       NP HD                     SORTED.UPDATE.FILEESR00400
```

Figure V-2a
PERT Editor (12-Tape Version)



```
      *FILE   3 *OU1      NP HD                       MESSAGE.FILE      ESR00410
      *FILE   4 *L1       NP HD                       OVERFLOW.FILE     ESR00420
      *FILE   5 *UT2      NP HD                       DUMMY OLD MASTER  ESR00430
      *FILE 006 *IN1      NI HD                       SYSIN1            ESR00440
      *LOAD    SYSIN1                                                   ESP00450
       ENDUP                                                    EDIT 027
      *FAP                                                      EDIT 028
       UPDATE  9,10,U             PHASE I ASSEMBLY              EDIT 029
       END     GOGO                                             EDIT 030ESR99990
      *FAP                                                      EDIT 031
       UPDATE  ,10,U,D        EOF ON 10                         EDIT 032
       ENDFIL  10                                               EDIT 033
       ENDUP                                                    EDIT 034
$IBSYS                                                          EDIT 035
$EXECUTE       IOCS               COPY 9PAC TO PP1 AND OU1      EDIT 036
      *JOB  PERT EDITOR         007        11400      MINIMUM
      *FILE 001 *J1       NI HD                       MASTER FILE
      *FILE 002 *IN1      NI HD                       SYSIN1 BCD
      *FILE 003 *OU1      NP HD                       SYSOU1 BCD
      *FILE 004 *PP1      NP HD                       SYSPP1 BCD
      *FILE 005 *PP1      NP HB                       SYSPP1 BINARY
      *FILE 006 *CK2      NI HD                       CHECK 2
      *FILE 007 *PP2      NI HB                       SYSPP2 BINARY
      *LOAD
-RX*(G74X 9, V=74X 9, 9(59(0S9 9/ 9X74X 9/74X 9( L=74X 9( =(59(0S9 9X74XPTED0000
-R(-((09X74X 9) V=74X 9) =(59X0S9 9X74X09X74X 9) W=74X 9) =(59(0S9 9X74XPTED0001
-RV((( 9) V=74X 9) =(59X0S9 9X74X 9( W=74X 9( =(59(0S9 9X74X 9X0$*74( 9/PTED0002
-R(P((-.(0Z(D9*19*99*7-,D9*) -) -99() 779*) 7E9X74X 9X0Z(74X 9X0$(59X74(PTED0003
-RXG-*-9/74(+9X74X09X74(+9X74X09X74X 9X0$P74X09X76=74( 9X-,*0Z(74X 9X0Z(PTED0004
-R,PU(74X 9X0$(-=(74X 9X74X 9X0$*74( 9X-Z(0Z(D9(G9*99*74X 9X0,(74( 9X-Z(PTED0005
-RX,,(0Z(D9(G9*G9*59(59(99*D9P99(74X 9X0,(D9*99(59(74( 9X-$X05 59(74(09XPTED0006
-R((-U74X 9X0$*76874( 9X-,*0Z(74X 9X0$(74X 9X0Z(-=(74(09X74X09XD9*99(74(PTED0007
-RP),( 9X-Z*0Z(74X 9X0$(D9*99(7-X 9(D9(G9*-9P99(74X 9X0,(59R74X 9X76674(PTED0008
-R*((( 9X-Z$0X -=*74( 9X-$*0,(74X 9X0,(59*74(09X74X09X74( 9X-,*0Z(74X 9XPTED0009
-RP)**0Z(D9*99(74X 9X0$(74(09X74X09X74( 9X-Z*0Z(74X 9X0$(D9*99(7-X 9(D9(PTED0010
-R***)G9*-9P99(74X 9X0,(59*74(09X74( 9X7RP 7  9*76974( 9X7R*0X -=*74( 9XPTED0011
-RP*(G7,*0,(74X 9X0,(59*74(09X74(-9X59*74(09X74(-9/74X 9X0=$74(  9 ZP59*PTED0012
-R*(X(74(09X74(09X74X 9X0=*74(  9 ZP59*74(09X74(09X74X 9X0Z*74(  9 ZP59*PTED0013
-RO(P(74(-9X74(09X74(09X74X 9X0=*74(  9 ZP59*74(09X74(09X74(-9X74X 9X0=PPTED0014
-R*(7(74(  9 ZP59*74(09X74(09X74X 9X0Z*74(  9 ZP59*74(09X74(09X74X 9X0,*PTED0015
-RP((*74(  9 ZP59*74(09X74X 9X0,P74(  9 ZP59*74(-9X74(09X74X 9X0ZZ74(  9PTED0016
-R$(X( ZP59*74(09X74(-9X74X 9X0ZR74(  9 ZP59*74(09X74(-9X74X 9X0Z$74(  9PTED0017
-RP=P* ZP59*74(09X74(09X74(-9X74X 9X0,*74(  9 ZP59*74(09X74(09X74(-9X74XPTED0018
-R*(X, 9X0=*74(  9 ZP59*74(09X74(-9X74X 9X0,*74(  9 ZP59*74(09X74(-9X74XPTED0019
-RP(X( 9X0ZP74(  9 ZP59*74(09X74(-9X74X 9X0=P74(  9 ZP59*74(09X74(-9X74XPTED0020
-,*.(X 9X0=*74(  9 ZP74(09X5 X  =  --   (X X((                          PTED0021
```

Figure V-2b
PERT Editor (12-Tape Version)

```
-RPC((7PPPPPPPP7PPPPPPPPPPPPPPPPPPPPPP**()XPPPPPPPPPPPPPPPPPPPPPPP7PPPPPPTED0022
-R*((PPPPPPPPPPPPPPPPT*)P))(GPPPPPPPPPPPPPPPPPPPPPP7PPPPPPPPPPPPPPPPPPPPPTED0023
-RP.(GPS)P))(GPPPPPPPPPPPPPPPPPPPPP7PPPPPPPPPPPPPPPPPPP***G(**)*)***PPPPPTED0024
-R*G(ZPPPPPPPPPPPPPPPP****PP()**;P*)(*X*G***P)P)G*GXPP-P**)XP(P*())***)*PTED0025
-RP(-(*G*.PP-P**)X)*)7(P(P(**(*X))()-)*G*.P**($)P()**P(P*****PP-P**)X)*(PTED0026
-R**$(7(P(P(**(P*P*P*XXP-)*G*.**)P7(*XP(***G*()*-P**)X)*)7*())R**)*XP-P*PTED0027
-RP**.*)X)*)7(P(P(**(*PX-P**)X)*(-***)$)P)P*X-P**)X)**P.X*$P-)*G*.P**(R7PTED0028
-R$((X(*XP*P(PX-P**)X*G(PT*(*(*P*(G*.PP-P**)X(P(P(**(*P*(G*I-P**)X()**)(PTED0029
-RP(XPP*I*G-P*)-)*G*.P**(**P**GP)P*XP*P*****P-P**)X)*(-**)P***P*P()**P(*PTED0030
-R*(S-**G(PX-P**)X)*(7(P(P(**(P*P*P*XXP-)**)P7(*XP(***G*()P)*)-G9(79(-9(PTED0031
-RX(XX-9X-9(-9(-9(549 -(PPP+7-+X IA .  C  7-(7-(7=(D49-9(75-G-(75 G  G=(PTED0032
-R()((- 7G=(- 7G=(94 G  G=(- 7G=(- 7G=(949(((--(-9X- P79XD9(99(74 75 76 PTED0033
-9X**(548PPP                                                            PTED0034
-R(-P*  0  1  2  3  4  5  6  7  8  9     =  -           +  A  B  C  D  EPTED0035
-RX-PM  F  G  H  I  0  .  )           -  J  K  L  M  N  O  P  Q  R  0  $PTED0036
-$Z*-(  *              /  S  T  U  V  W  X  Y  Z     ,  (         PPP   PTED0037
-9()X)*)**PP                                                            PTED0038
-9X                                                                     TRA11524
$IBSYS                                                                  FSR00900
$EXECUTE       SORT                                                     FSR00910
      OPTION,NOCKPT,VARIABLE BLOCKING                                   FSR00920
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1                          FSR00930
      RECORD,LENGTH/14,TYPE/F,FIELDS/(1,4,8,2,8)                        FSR00940
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/D,BLOCKSIZE/70                 FSR00950
      FILE,OUTPUT,DENSITY/H,MODE/D,BLOCKSIZE/70                         FSR00960
      SORT,FILE/1,SEQUENCE/C,ORDER/2,FIELDS/(5,3,1)                     FSR00970
      END                                                               FSR00980
$IBSYS                                                                  FSR00990
$EXECUTE       9PAC                                                     CUP 0300
      *JOB  FPBIN            PERT FILE UPDATE                           CUP 0310
 H0240*FILERU00 *UT2      NI HD                       OLD MASTER FILE   CUP 0320
 H0240*FILERR10 *UT1      NI HD                        RPG INPUT        CUP 0330
 H0240*FILERR07 *UT1      NT HD                       NEW MASTER FILE   CUP 0340
 H0035*FILERR08 *J1       NT HD                       ERROR DATA FILE   CUP 0350
  0075*FILERR11 *L1       NI HD                       CHANGE DATA FILE  CUP 0360
  G   *FILENS01 *OU1      NT HD                       RPG OUTPUT        CUP 0370
  0240*FILERR02 *UT4      NT HB                        PEN LIST FILE    CUP 0380
      *END                                                              CUP 0390
-    END OF FILE CARD                                           EDIT 137
      *JOB  RGBIN            PERT ERROR REPORT                          DUP 0300
 H0020*FILERR10 *J1       NI HD                       ERROR DATA FILE   DUP 0310
  G   *FILENS11 *OU1      NT HD                       ERROR REPORT      DUP 0320
      *END                                                              DUP 0330
-    END OF FILE CARD                                           EDIT 138
$IBSYS                                                          EDIT 139
$EXECUTE       IBSFAP                                           EDIT 140
```

Figure V-2c
PERT Editor (12-Tape Version)

```
      *FAP                                                       EDIT 141
       UPDATE  ,8,U,D            INPUT CONTROL CARDS             EDIT 142
GIN    NUMBER  30                                                EDIT 143
$IBSYS                                                                   GIN00300
$EXECUTE       IOCS                                                      GIN00310
      *JOB  PERT INPUT BRYSON     7        11400      MINIMUM            GIN00320
      *FILE   1 *UT1      NI HD                       MASTER FILE        GIN00330
      *FILE   2 *L2       NP HB                       ACTIVITIES         GIN00340
      *FILE   3 *UT3      NP HB                       SCHEDULED DATES    GIN00350
      *FILE   4 *UT4      NP HB                       EVENT NOMENCLATUREGIN00360
      *FILE   5 *UT4      NP HB                       PEN LIST           GIN00370
      *FILE   6 *OU1      NP HD                       SYSTEMS OUTPUT     GIN00380
      *FILE   7 *UT4      NI HB                       EVENT NOMENCLATUREGIN00390
      *LOAD                                                              GIN00400
       ENDUP                                                     EDIT 144
      *FAP                                                       EDIT 145
       UPDATE  9,10,U            INPUT ASSEMBLY                  EDIT 146
       END     GOGO                                                      GIN99990
      *FAP                                                       EDIT 148
       UPDATE  ,8,U,D            RANK CONTROL CARDS              EDIT 149
      *JOB     ADAMS-RANK       009        11400      MINIMUM            HRK00300
      *FILE 001 *L2       NI HB                       ACTIVITIES         HRK00310
      *FILE 002 *UT2      NP HB                       TACTW              HRK00320
      *FILE 003 *UT2      NI HB                       TATWI              HRK00330
      *FILE 004 *L1       NP HB                       RANK FORWARD       HRK00340
      *FILE 005 *J1       NP HB                       RANK BACKWARD      HRK00350
      *FILE 006 *UT4      NI HB                       PEN LIST           HRK00360
      *FILE 007 *L1       NI HB                       TEF1               HRK00370
      *FILE 008 *J1       NI HB                       TEF2               HRK00380
      *FILE 009 *OU1      NP HD                       SYSOU1             HRK00390
      *LOAD                                                              HRK00400
       ENDUP                                                     EDIT 151
      *FAP                                                       EDIT 152
       UPDATE  9,10,U            RANK ASSEMBLY                   EDIT 153
       END     R                                                         HRK99990
      *FAP                                                       EDIT 155
       UPDATE  ,8,U,D            SUMMARY CONTROL CARDS           EDIT 156
ISM    NUMBER  30                                                EDIT 157
      *JOB  SUMMARY SOL         003        11400      MINIMUM            ISM00300
      *FILE 001 *L1       NI HB                       RANK FORWARD       ISM00310
      *FILE 002 *UT2      NP HB                       SUM. REPORT        ISM00320
      *FILE 003 *OU1      NP HD                       SYS OUTPUT         ISM00330
      *LOAD                                                              ISM00340
       ENDUP                                                     EDIT 158
      *FAP                                                       EDIT 159
       UPDATE  9,10,U            ASSEMBLE SUMMARY                EDIT 160
```

Figure V-2d
PERT Editor (12-Tape Version)

```
       END     SR                                                       ISM99990
      *FAP                                                      EDIT 162
       UPDATE  ,8,U,D             SUMMARY OUTPUT CONTROL        EDIT 163
ISO    NUMBER  30                                               EDIT 164
$IBSYS                                                                  IS000300
$ATTACH        A8 TAPE UNIT FOR SUMMARY OUTPUT COULD BE B8              IS000310
$AS            SYSPP1,H                                                 IS000320
$EXECUTE       IOCS                                                     IS000330
      *JOB  SUMMARY OUTPUT      009        11400      MINIMUM           IS000340
      *FILE 001 *UT4      NI HB                       TITLES PEN L      IS000350
      *FILE 002 *UT3      NI HB                       SDL LIST          IS000360
      *FILE 003 *UT3      NP HB                       PAR OUT           IS000370
      *FILE 004 *UT2      NI HB                       SUMMARY REPORT    IS000380
      *FILE 005 *PP1      NP HB                       1/4/3/6-CODES OUT IS000390
      *FILE 006 *PP1      NI HB                       1/4/3/6-CODES IN  IS000400
      *FILE 007 *IN1      NI HM                       SYS INPUT         IS000410
      *FILE 008 *PP1      NP HD                       CARD OUTPUT       IS000420
      *FILE 009 *OU1      NP HD                       SYS OUTPUT        IS000430
      *LOAD                                                             IS000440
       ENDUP                                                    EDIT 165
      *FAP                                                      EDIT 166
       UPDATE  9,10,U             SUMMARY OUTPUT ASSEM          EDIT 167
       END     SX                                                       IS099990
      *FAP                                                      EDIT 169
       UPDATE  ,8,U,D             FWE - BKE CONTROL CARDS       EDIT 170
JFW    NUMBER  30                                               EDIT 171
$IBSYS                                                                  JFW00300
$ENDFILE       SYSPP1                                                   JFW00310
$ENDFILE       SYSPP1                                                   JFW00320
$ENDFILE       SYSPP1                                                   JFW00330
$REMOVE        SYSPP1 REWIND AND UNLOAD SUMMARY OUTPUT                  JFW00340
$*OR IF SUMMARY WAS NOT REQUESTED RELOAD AND READY A8                   JFW00350
$*IF SUMMARY OUTPUT WAS REQUESTED, A8 CONTAINS SUMMARY OUTPUT   T/C     JFW00360
$*MOUNT NEW TAPE ON A8 AND PRESS START TO CONTINUE                      JFW00370
$*THIS IS NOT NECESSARY ON 16 TAPE VERSION.                             JFW00380
$RELEASE       SYSPP1                                                   JFW00390
$PAUSE                                                                  JFW00400
$EXECUTE       IOCS                                                     JFW00430
      *JOB  EVENTS FWE-BKE GA   007        11400      MINIMUM           JFW00440
      *FILE 001 *UT3      NI HB                       SCHEDULED DATES   JFW00450
      *FILE 002 *UT2      NP HB                       FEL AND BEL       JFW00460
      *FILE 003 *L1       NI HB                       RANK FORWARD      JFW00470
      *FILE 004 *UT4      NI HB                       PEN LIST          JFW00480
      *FILE 005 *OU1      NP HD                       SYSTEM OUTPUT     JFW00490
      *FILE 006 *UT3      NP HB                       FINAL SDL LIST    JFW00500
      *FILE 007 *J1       NI HB                       RANK REVERSE      JFW00510
```

Figure V-2e
PERT Editor (12-Tape Version)

```
         *LOAD                                                                     JFW00520
          ENDUP                                                       EDIT 172
         *FAP                                                         EDIT 173
          UPDATE   9,10,U            FWE - BKE ASSEM                  EDIT 174
          SKIPTO                                                                   JFW01000
          END      FW                                                              JFW99990
         *FAP                                                         EDIT 177
          UPDATE   ,8,U,D            DEBUG CONTROL CARDS              EDIT 178
KDB       NUMBER   30                                                 EDIT 179
         *JOB  FIKE DUMP CODE      009        20000     BASIC                      KDB00300
         *FILE 001 *UT3      NI HB                      SDL                        KDB00310
         *FILE 002 *UT4      NI HP                      TITLES                     KDB00320
         *FILE 003 *UT4      NI HB                      PEN                        KDB00330
         *FILE 004 *L2       NI HB                      ACTIV                      KDB00340
         *FILE 005 *L1       NI HB                      RANK                       KDB00350
         *FILE 006 *J1R      NI HB                      RANK REVERSE               KDB00360
         *FILE 007 *UT2      NI HB                      FEL                        KDB00370
         *FILE 008 *UT2      NI HB                      BEL                        KDB00380
         *FILE 009 *LB2      NP HB                      DUMP                       KDB00390
         *LOAD                                                                     KDB00400
          ENDUP                                                       EDIT 180
         *FAP                                                         EDIT 181
          UPDATE   9,10,U            DEBUG ASSEMBLY                   EDIT 182
          END      GOGOGO                                                          KDP99990
         *FAP                                                         EDIT 184
          UPDATE   ,8,U,D            EVENT ASSEM CONTROL CARDS        EDIT 185
LEA       NUMBER   30                                                 EDIT 186
         *JOB  PERT EVENT ASSEM    012        11400     MINIMUM                    LEA00300
         *FILE 001 *UT2      NI HB                      FELF                       LEA00310
         *FILE  02 *UT4      NI HB                      PENF                       LEA00320
         *FILE 003 *UT2      NI HB                      BELF                       LEA00330
         *FILE  04 *UT3      NI HB                      SDLF                       LEA00340
         *FILE  05 *UT4      NI HB                      ENOMF                      LEA00350
         *FILE 006 *L1       NP HB                      EALT                       LEA00360
         *FILE 007 *L1       NP HB                      EAPAT                      LEA00370
         *FILE 008 *L1       NP HB                      EASOT                      LEA00380
         *FILE  09 *UT3      NP HB                      EACOR                      LEA00390
         *FILE  10 *IN1      NI HM                      EASYI                      LEA00400
         *FILE 011 *L1       NP HB                      EAENF                      LEA00410
         *FILE  12 *OU1      NP HD                      EAERF                      LEA00420
         *LOAD                                                                     LEA00430
          ENDUP                                                       EDIT 187
         *FAP                                                         EDIT 188
          UPDATE   9,10,U            EVENT ASSEMBLY I                 EDIT 189
          END      EA3B                                                            LEA99990
         *FAP                                                         EDIT 191
```

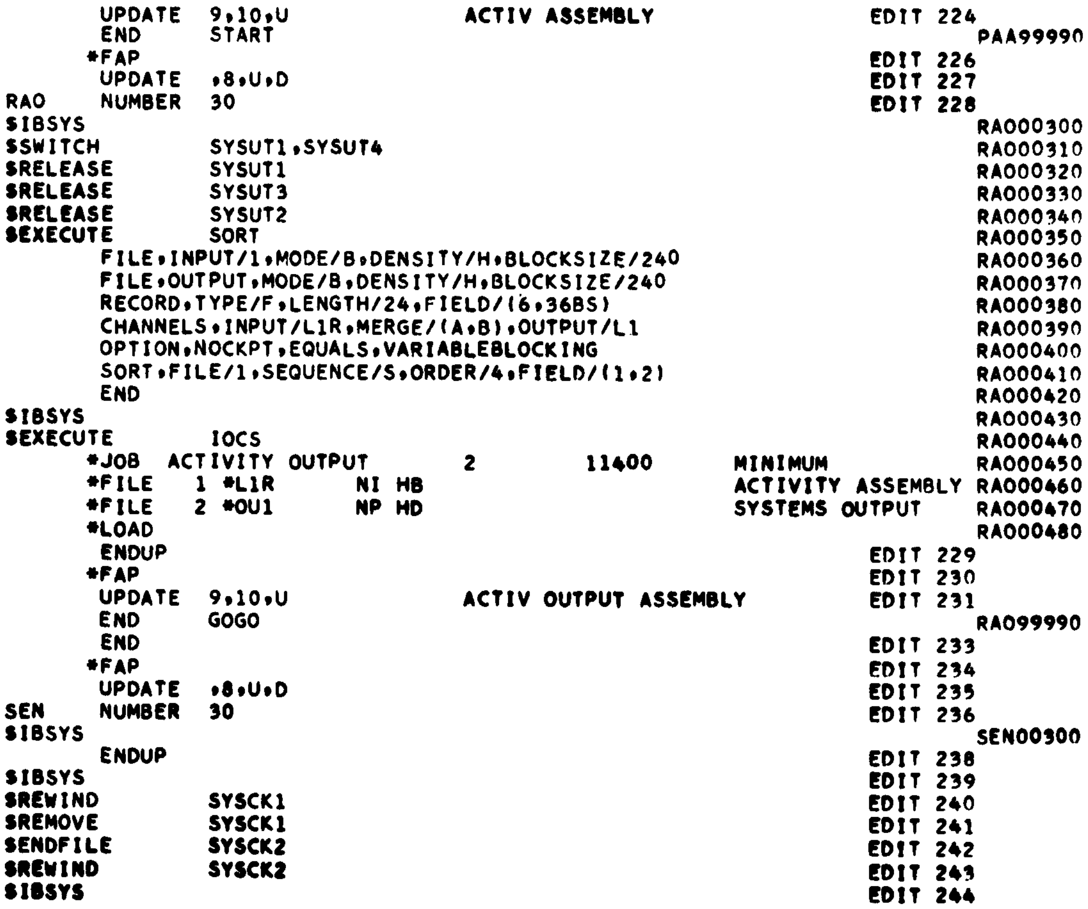
Figure V-2f
PERT Editor (12-Tape Version)

```
       UPDATE  ,8,U,D             EVENT 90 SORT PROG.           EDIT 192
MEA    NUMBER  30                                               EDIT 193
$IBSYS                                                                  MEA00300
$EXECUTE       SORT                                                     MEA00310
      OPTION,NOCKPT,VARIABLEBLOCKING                                    MEA00320
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/J1                          MEA00330
      RECORD,LENGTH/6,TYPE/F,FIELD/32B                                  MEA00340
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/246                MEA00350
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/246                        MEA00360
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/1                            MEA00370
      END                                                               MEA00380
$IBSYS                                                                  MEA00390
$EXECUTE       IOCS                                                     MEA00400
      *JOB  EVENT ASSEM PART2   008        11460      MINIMUM           MEA00410
      *FILE  01 *UT4      NI HB                    ENOMF             MEA00420
      *FILE 002 *L1       NP HB                    EALT              MEA00430
      *FILE 003 *J1R      NI HB                    EAPAT             MEA00440
      *FILE 004 *L1       NP HB                    EASOT             MEA00450
      *FILE  05 *UT3      NP HB                    EACOR             MEA00460
      *FILE  06 *IN1      NI HM                    EASYI             MEA00470
      *FILE  07 *UT3      NI HB                    EA55T             MEA00480
      *FILE  08 *OU1      NP HD                    EAERF             MEA00490
      *LOAD                                                             MEA00500
       ENDUP                                                    EDIT 194
      *FAP                                                      FDIT 195
       UPDATE  9,10,U                                           EDIT 196
       END     EA55G                                                    MEA99990
      *FAP                                                      EDIT 198
       UPDATE  ,8,U,D             EVENT 90 SORT PROG 2          EDIT 199
NEO    NUMBER  30                                               EDIT 200
$IBSYS                                                                  NEO00300
$EXECUTE       SORT                                                     NEO00310
      OPTION,NOCKPT,VARIABLEBLOCKING                                    NEO00320
      RECORD,LENGTH/14,TYPE/F,FIELD/(36B,36BS)                          NEO00330
      CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1                          NEO00340
      FILE,INPUT/1,REEL/1,DENSITY/H,MODE/B,BLOCKSIZE/238                NEO00350
      FILE,OUTPUT,DENSITY/H,MODE/B,BLOCKSIZE/238                        NEO00360
      SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/(1,2)                        NEO00370
      END                                                               NEO00380
$IBSYS                                                                  NEO00390
$EXECUTE       IOCS                                                     NEO00400
      *JOB  EVENT PRINTOUT      002        11400      MINIMUM           NEO00410
      *FILE 001 *L1       NI HB                    EVENT ASSEMBLY    NEO00420
      *FILE 002 *OU1      NP HD                    SYSOU1            NEO00430
      *LOAD                                                             NEO00440
       ENDUP                                                    EDIT 201
```

Figure V-2g
PERT Editor (12-Tape Version)

```
      *FAP                                                      EDIT 202
       UPDATE  9,10,U             EVENT OUTPUT ASSEMBLY         EDIT 203
       END     XEV                                                      NEO99990
      *FAP                                                      EDIT 205
       UPDATE  ,8,U,D             EL CHART CONTROL              EDIT 206
OEL    NUMBER  30                                               EDIT 207
      *JOB  E-L CHART           002        11400      MINIMUM           OEL00300
      *FILE 001 *L1       NI HB                       EVENT ASSEMBLY    OEL00310
      *FILE 002 *OU1      NP HD                       SYSOU1            OEL00320
      *LOAD                                                             OEL00330
       ENDUP                                                    EDIT 208
      *FAP                                                      EDIT 209
       UPDATE  9,10,U             EL CHART ASSEMBLY             EDIT 210
       END     EL                                                       OEL99990
      *FAP                                                      EDIT 212
       UPDATE  ,8,U,D             EL MO. CHART CONTROL CARDS    EDIT 213
OEM    NUMBER  30                                               EDIT 214
      *JOB  E-L MONTH CHART     002        11400      MINIMUM           OEM00300
      *FILE 001 *L1       NI HB                       EVENT ASSEMBLY    OEM00310
      *FILE 002 *OU1      NP HD                        SYSOU1           OEM00320
      *LOAD                                                             OEM00330
       ENDUP                                                    EDIT 215
      *FAP                                                      EDIT 216
       UPDATE  9,10,U             EL MONTH CHART ASSEMBLY       EDIT 217
       END     M                                                        OEM99990
      *FAP                                                      EDIT 219
       UPDATE  ,8,U,D             ACTIVITY ASSEM CONTROL CARDS  EDIT 220
PAA    NUMBER  30                                               EDIT 221
      *JOB  ACTIVITY ASSEMBLY    14        11400      MINIMUM           PAA00300
      *FILE  01 *UT1      NI HD                       MASFIL            PAA00310
      *FILE  02 *L1       NP HB                       ACT ASSEMBLY TAPE PAA00320
      *FILE  03 *UT4      NI HB                       PENT              PAA00330
      *FILE  04 *UT3      NI HB                       SDLT              PAA00340
      *FILE 005 *UT2      NI HB                       FELT              PAA00350
      *FILE 006 *UT2      NI HB                       BELT              PAA00360
      *FILE  07 *L2R      NI HB                       ACT UNRANKED      PAA00370
      *FILE  08 *S1       NP HB                       INTTO             PAA00380
      *FILE  09 *S1       NI HB                       INTTI             PAA00390
      *FILE  10 *L1       NP HB                       SCRAT             PAA00400
      *FILE  11 *UT4      NI HB                       NOMT              PAA00410
      *FILE  12 *L1       NI HB                       SORT              PAA00420
      *FILE  13 *IN1      NI HD                       SKIP   SYSIN      PAA00430
      *FILE  14 *OU1      NP HD                       ERRTAP SYSOUT     PAA00440
      *LOAD                                                             PAA00450
       ENDUP                                                    EDIT 222
      *FAP                                                      EDIT 223
```

Figure V-2h
PERT Editor (12-Tape Version)



```
       UPDATE  9,10,U             ACTIV ASSEMBLY                EDIT 224
       END     START                                                    PAA99990
      *FAP                                                      EDIT 226
       UPDATE  ,8,U,D                                           EDIT 227
RAO    NUMBER  30                                               EDIT 228
$IBSYS                                                                  RA000300
$SWITCH        SYSUT1,SYSUT4                                            RA000310
$RELEASE       SYSUT1                                                   RA000320
$RELEASE       SYSUT3                                                   RA000330
$RELEASE       SYSUT2                                                   RA000340
$EXECUTE       SORT                                                     RA000350
       FILE,INPUT/1,MODE/B,DENSITY/H,BLOCKSIZE/240                      RA000360
       FILE,OUTPUT,MODE/B,DENSITY/H,BLOCKSIZE/240                       RA000370
       RECORD,TYPE/F,LENGTH/24,FIELD/(6,36BS)                           RA000380
       CHANNELS,INPUT/L1R,MERGE/(A,B),OUTPUT/L1                         RA000390
       OPTION,NOCKPT,EQUALS,VARIABLEBLOCKING                            RA000400
       SORT,FILE/1,SEQUENCE/S,ORDER/4,FIELD/(1,2)                       RA000410
       END                                                              RA000420
$IBSYS                                                                  RA000430
$EXECUTE       IOCS                                                     RA000440
      *JOB  ACTIVITY OUTPUT       2        11400      MINIMUM           RA000450
      *FILE   1 *L1R      NI HB                       ACTIVITY ASSEMBLY RA000460
      *FILE   2 *OU1      NP HD                       SYSTEMS OUTPUT    RA000470
      *LOAD                                                             RA000480
       ENDUP                                                    EDIT 229
      *FAP                                                      EDIT 230
       UPDATE  9,10,U             ACTIV OUTPUT ASSEMBLY         EDIT 231
       END     GOGO                                                     RA099990
       END                                                      EDIT 233
      *FAP                                                      EDIT 234
       UPDATE  ,8,U,D                                           EDIT 235
SEN    NUMBER  30                                               EDIT 236
$IBSYS                                                                  SEN00300
       ENDUP                                                    EDIT 238
$IBSYS                                                          EDIT 239
$REWIND        SYSCK1                                           EDIT 240
$REMOVE        SYSCK1                                           EDIT 241
$ENDFILE       SYSCK2                                           EDIT 242
$REWIND        SYSCK2                                           EDIT 243
$IBSYS                                                          EDIT 244
```

Figure V-2i
PERT Editor (12-Tape Version)

APPENDIX A

SAMPLE INPUT AND OUTPUT FORMATS

APPENDIX A

SAMPLE INPUT AND OUTPUT FORMATS

Input formats, sample output formats, and USAF PERT program capabilities are illustrated in this Appendix through the use of three sample networks, a Guidance System Network, Figure A-1, an Airframe System Network, Figure A-2, and a Re-entry System Network, Figure A-3. Each network shows three time estimates above each activity line and the computed t_e below the activity lines. Expected Dates, Latest Allowable Dates and Slack were computed individually for each network. Each detailed network was then summarized to Level Code A. The resulting summary network for each sample system is shown on the same page as the detailed network.

Expected, Latest Allowable, and Scheduled Completion Dates, as well as Slack, are shown for each appropriate event on the summary networks.

The integrated network shown in Figure A-4 is a composite of the summary data for the three networks after integration by the computer. A comparison of Latest Allowable Dates and Slack values shown for each individual network with those shown on the integrated network will reveal that integration has made a substantial change in the program completion date.

AFSC forms 30 and 30A are used to input data for computer processing. To illustrate these forms and their proper usage, data from the Guidance System Network (Figure A-1) has been transferred to the AFSC Forms 30 and 30A, shown as Figures A-5 and A-6 respectively. The back of AFSC Form 30 has been reproduced here to illustrate the instructions for its completion, and detailed instructions concerning the use of the form are found in Section E of Chapter I of this volume. The Form 30A does not contain instructions.

A variety of output reports for these networks are also illustrated. Figures A-7 through A-17 show, for the Guidance Systems Network, all of the options available with the exception of the E-L Chart (Weeks) without D's. Figures A-18 and A-19 show Event Reports by event number sequence for the detailed Airframe System Network and Reentry System Network respectively. Figure A-20 shows the PERT Master File Report for the integrated summary program network of Figure A-4, and the Event Report by expected date sequence for the same summary network is illustrated in Figure A-21.

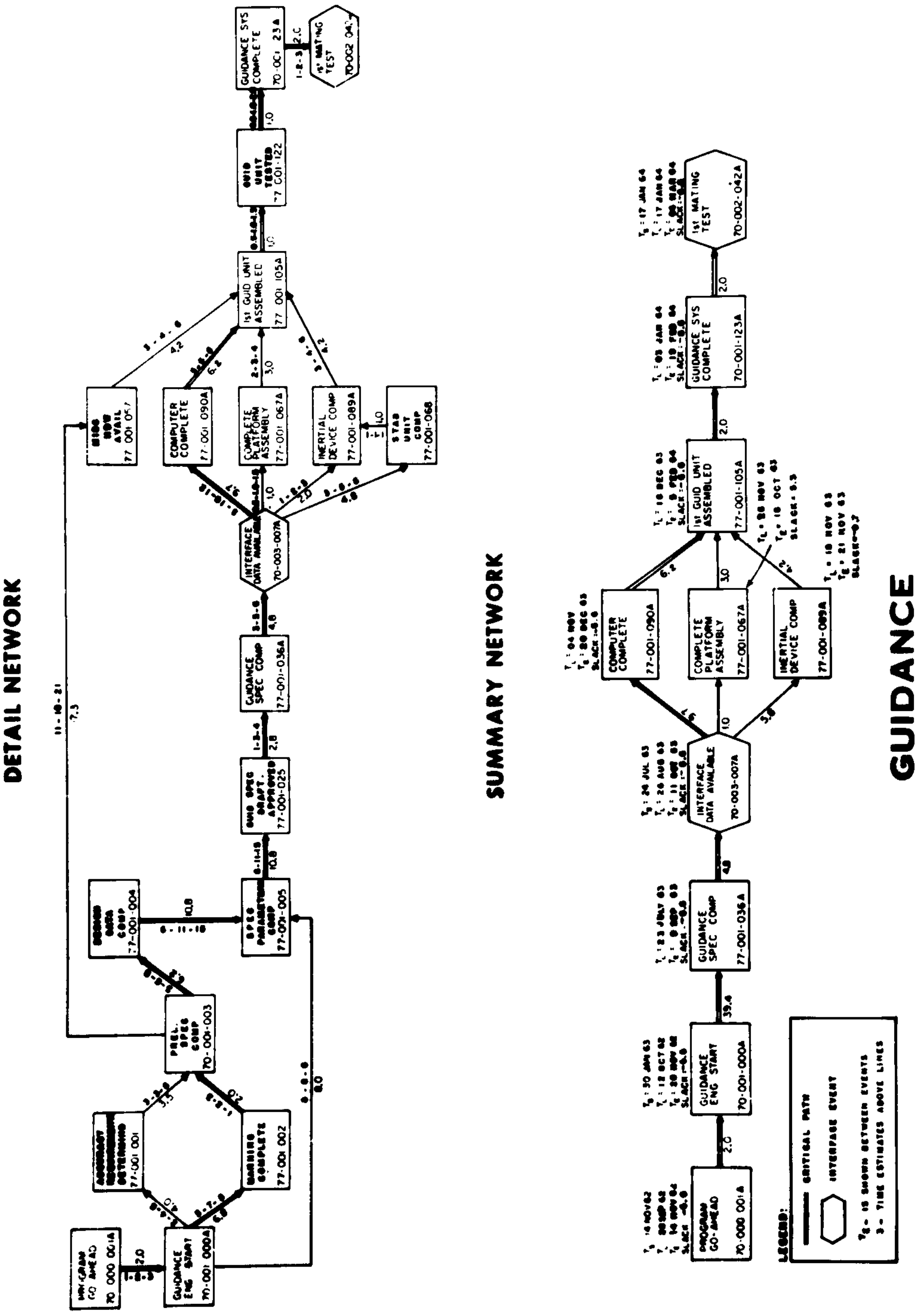

GUIDANCE
DETAIL NETWORK
SUMMARY NETWORK
PROGRAM GO-AHEAD 70-000-001A
GUIDANCE ENG START 70-001-000A
PREL. SPEC COMP 70-001-003
SPEC PARAMETERS COMP 77-001-005
GUID SPEC DRAFT APPROVED 77-001-025
GUIDANCE SPEC COMP 77-001-036A
INTERFACE DATA AVAILABLE 70-003-007A
COMPUTER COMPLETE 77-001-090A
COMPLETE PLATFORM ASSEMBLY 77-001-067A
INERTIAL DEVICE COMP 77-001-089A
STAB UNIT COMP 77-001-068
1ST GUID UNIT ASSEMBLED 77-001-105A
GUID UNIT TESTED 77-001-122
GUIDANCE SYS COMPLETE 70-001-123A
1ST MATING TEST 70-002-042A
LEGEND:
CRITICAL PATH
INTERFACE EVENT
T_E - IS SHOWN BETWEEN EVENTS
3 - TIME ESTIMATES ABOVE LINES

Figure A-1
Guidance System Network

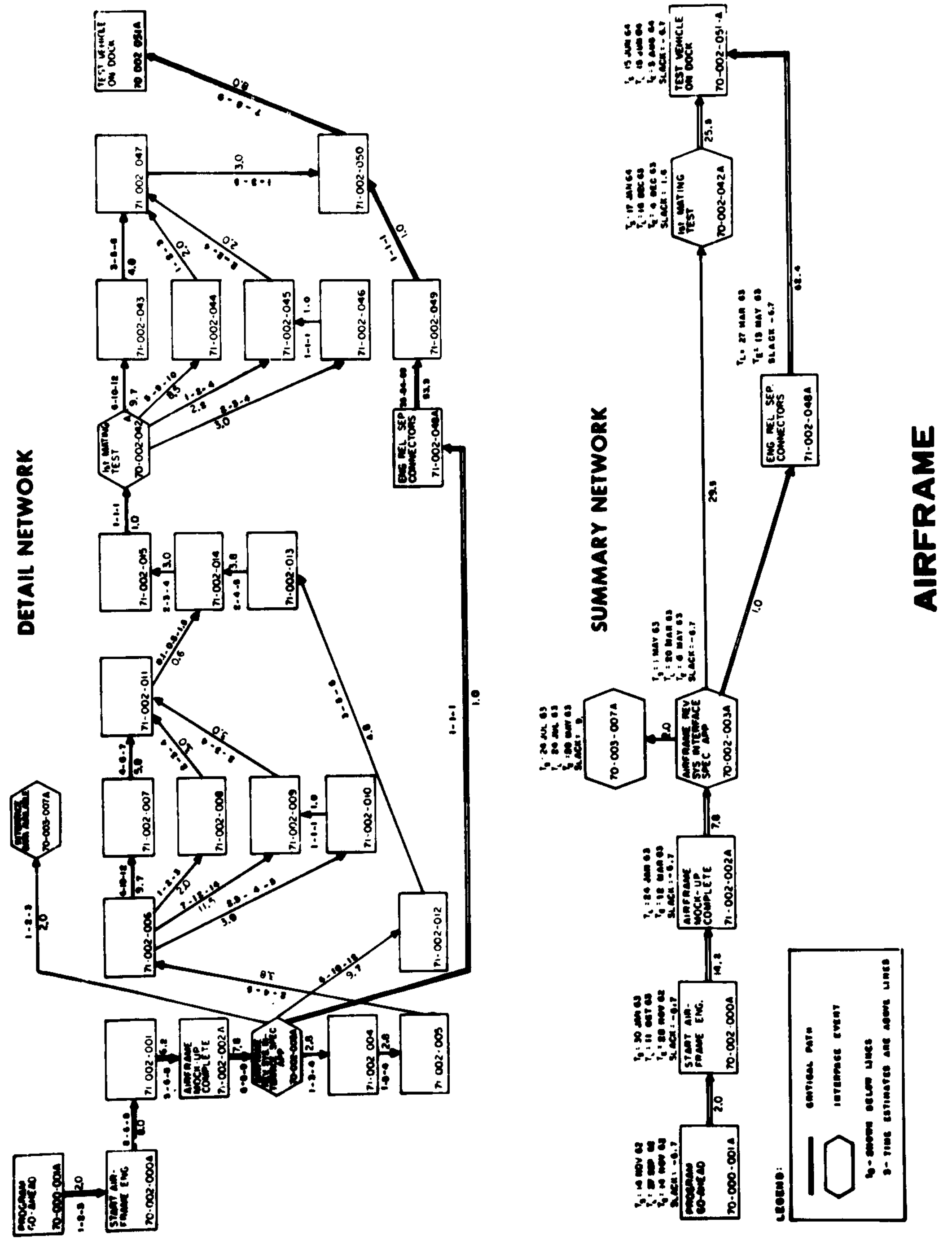


Figure A-2
Airframe System Network

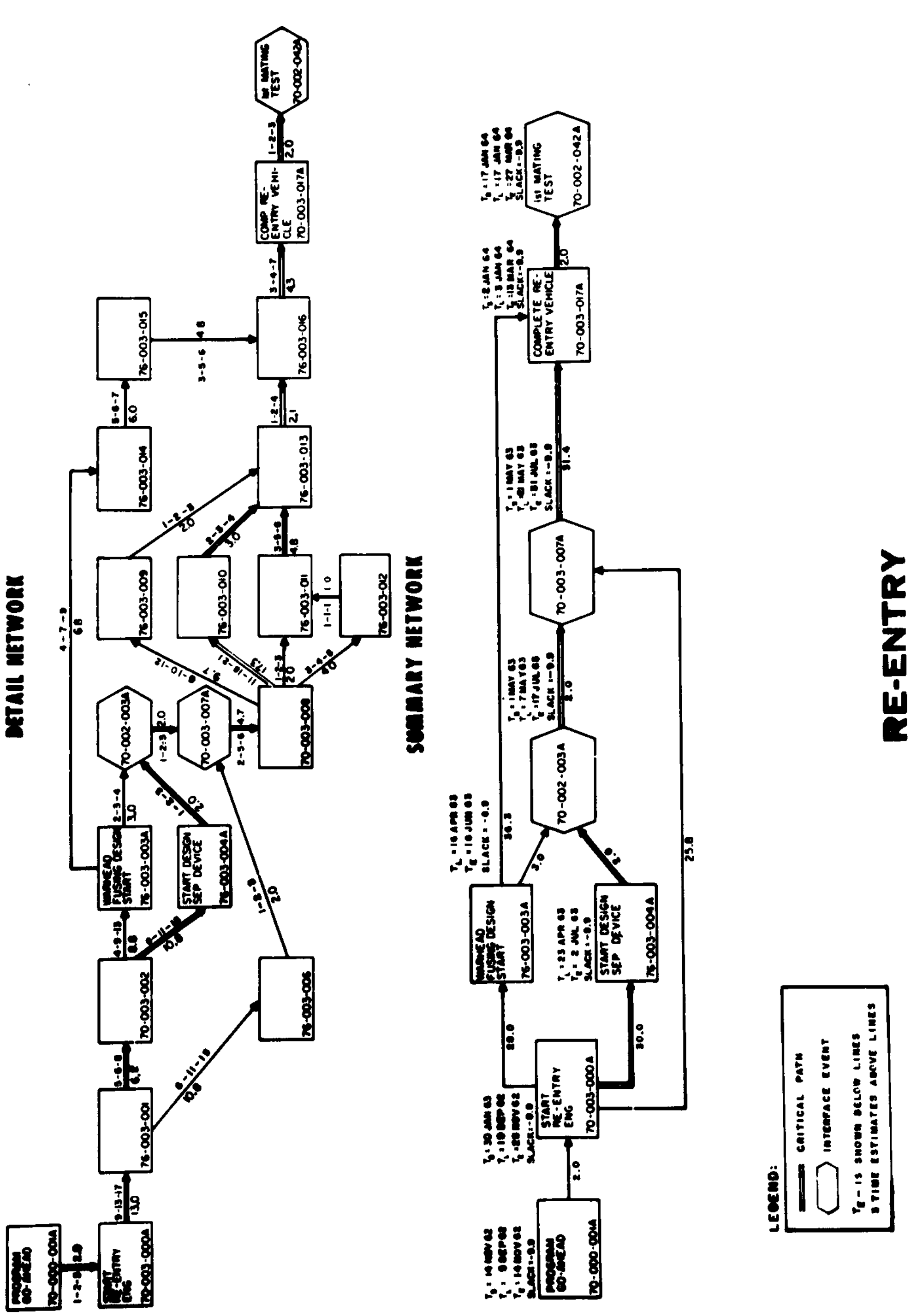

DETAIL NETWORK
PROGRAM GO-AHEAD 70-000-004A
START RE-ENTRY ENG 70-003-000A
76-003-001
70-003-002
76-003-006
WARHEAD FUSING DESIGN START 76-003-003A
START DESIGN SEP DEVICE 76-003-004A
70-002-003A
70-003-007A
70-003-008
76-003-009
76-003-010
76-003-011
76-003-012
76-003-013
76-003-014
76-003-015
76-003-016
COMP RE-ENTRY VEHICLE 70-003-017A
1st MATING TEST 70-002-042A
SUMMARY NETWORK
PROGRAM GO-AHEAD 70-000-004A
START RE-ENTRY ENG 70-003-000A
WARHEAD FUSING DESIGN START 76-003-003A
START DESIGN SEP DEVICE 76-003-004A
70-002-003A
70-003-007A
COMPLETE RE-ENTRY VEHICLE 70-003-017A
1st MATING TEST 70-002-042A
2.0
20.0
25.8
31.4
LEGEND:
CRITICAL PATH
INTERFACE EVENT
TE - IS SHOWN BELOW LINES
3 TIME ESTIMATES ABOVE LINES
RE-ENTRY

Figure A-3
Re-Entry System Network

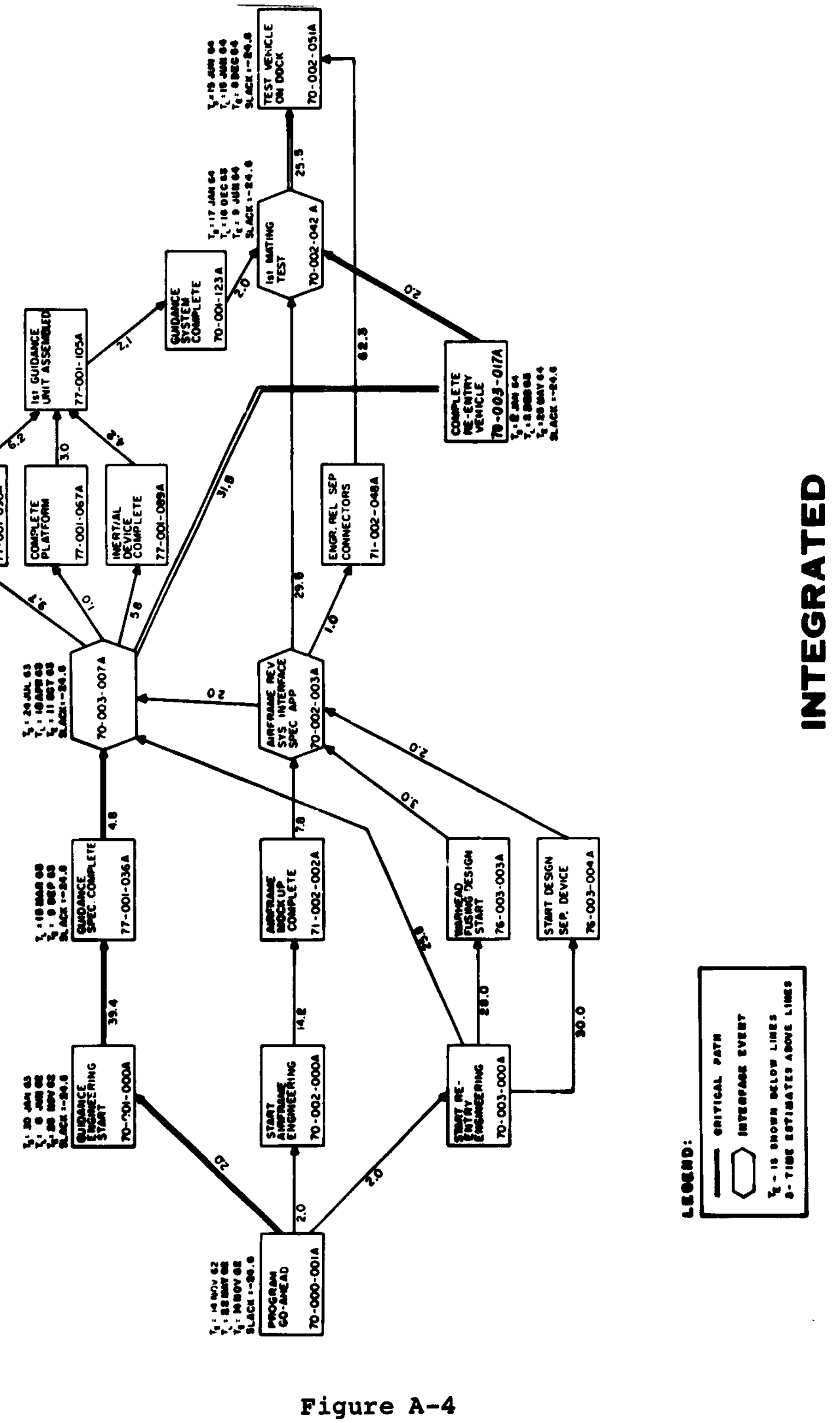


Figure A-4
Integrated Summary Network

SECURITY CLASSIFICATION

PAGE 1 OF 2 PAGES

Form Approved
Budget Bureau No. 21-R208

PERT TIME INPUT FORM

INITIAL CARD

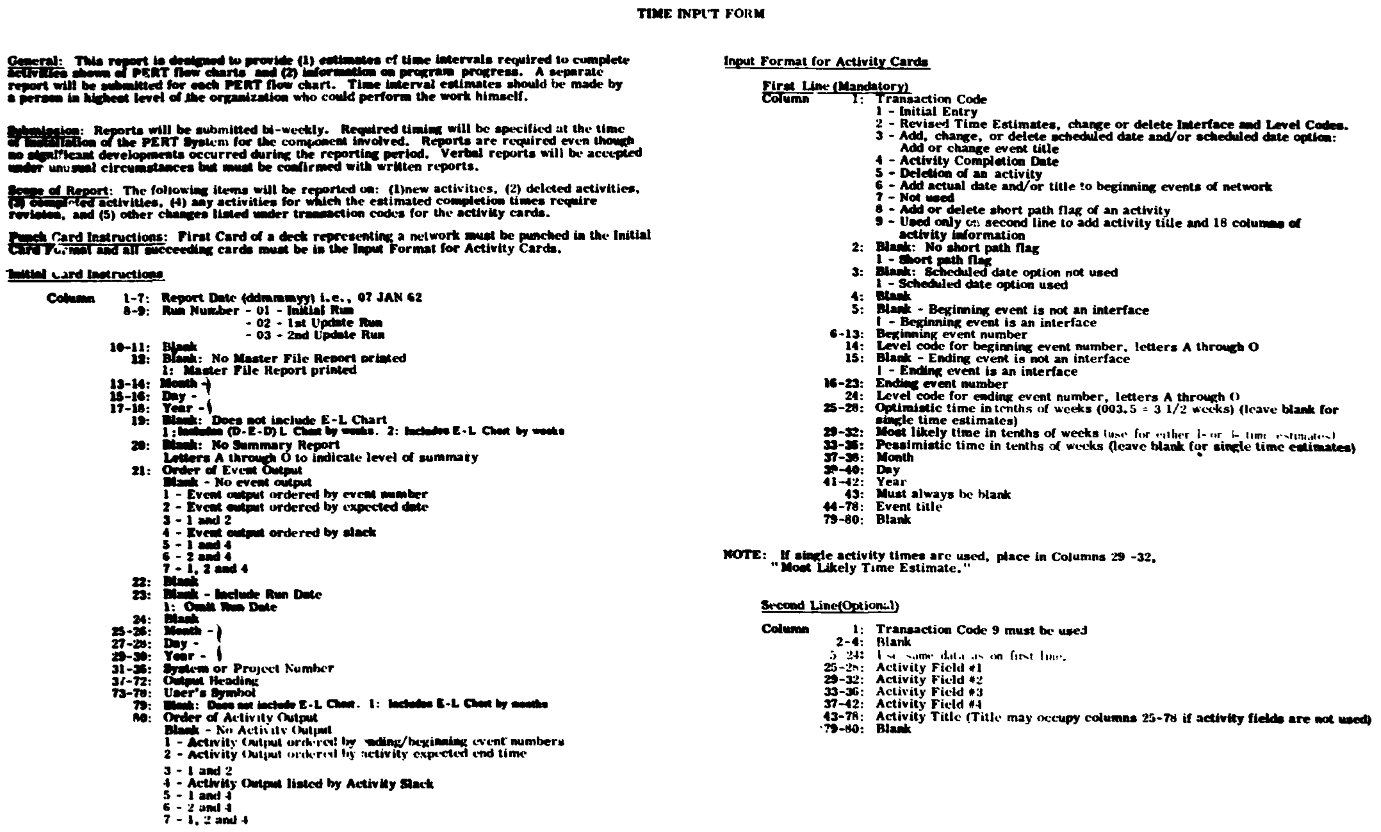
REPORT DATE DAY	MO	YR	RUN NO	BLANK	BLANK	MASTER FILE	NETWORK START DATE MO	DAY	YR	E-L CHART WKS	SUMMARY	EVENT OUTPUT	BLANK	RUN DATE	BLANK	NETWORK COMPLETION DATE MO	DAY	YR	SYSTEM OR PROJECT NUMBER	OUTPUT HEADING	USER'S SYMBOL	E-L CHART NOS	ACTIVITY OUTPUT
1-2	3-5	6-7	8-9	10	11	12	13-14	15-16	17-18	19	20	21	22	23	24	25-26	27-28	29-30	31-36	37-72	73-78	79	80
01	NOV	62	01			1	11	14	62	1	A	7		1		01	17	64	21357	GUIDANCE NET	USAF	1	7

TRANSACTION CARDS

TRANS CODE	SHORT PATH FLAG	SCHEDULE DATE		INTERFACE (B.E.)	BEGINNING EVENT NUMBER	LEVEL CODE (B.E.)	INTERFACE (E.E.)	ENDING EVENT NUMBER	LEVEL CODE (E.E.)	OPTIMISTIC TIME / ACTIVITY FIELD NO 1	MOST LIKELY TIME / ACTIVITY FIELD NO 2	PESSIMISTIC TIME / ACTIVITY FIELD NO 3	SCHEDULED OR COMPLETED DATE MO DAY YR / ACTIVITY FIELD NO 4	BLANK	EVENT TITLE (Ending Event) / ACTIVITY TITLE	BLANK	BLANK
1	2	3	4	5	6-13	14	15	16-23	24	25-28	29-32	33-36	37-42	43	44-78	79	80
1								70000001	A	.	.	.	11 14 62		PROGRAM GO AHEAD		
	.																
1					70000001	A		70001000	A	001.0	002.0	003.0	01 30 63		START GUIDANCE ENG NEERING		
9		.													AUTHORIZE GUIDANCE DIV TO START		
1					1000	A		77001001		002.0	004.0	006.0			ACCURACY RQMTS DETERMINED		
9								1							DETERMINING REQUIREMENTS		
1								2		005.0	007.0	008.0			MANNING COMPLETE		
9								2							MANNING DESIGN UNIT		
1								5		008.0	008.0	008.0			SPEC PARAMETERS COMPLETE		
9					70001000	A		77001005							DETERMINING SPEC PARAMETERS		
1					77001001			70001003		003.0	003.0	006.0			PRELIMINARY SPEC COMPLETE		
9					1										DETERMINING PRELIMINARY SPEC RQMTS		
1					2					001.0	002.0	003.0					
9					77001002			70001003							ASSIGNING PERSONNEL		
1					70001003			77001004		005.0	006.0	008.0			DESIGN DATA COMPLETE		
9															DETERMINING FINAL DESIGN DATA		
1								57		011.0	018.0	021.0			MISC HARDWARE AVAILABLE		
9					70001003										PROCURING HARDWARE		
1					77001004			05		006.0	011.0	015.0					
9															PREPARE SPEC PARAMETERS		
1					05			25		006.0	011.0	015.0			GUIDANCE SPEC DRAFT APPROVED		
9															REVIEWING DRAFT OF GUIDANCE SPEC		
1					77001025			77001036	A	001.0	003.0	004.0			GUIDANCE SPEC COMPLETE		
9															PRINT GUIDANCE SPEC		

AFSC FORM JUL 63 30 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. SECURITY CLASSIFICATION AFSC (AAFB, 1963)

Figure A-5a
AFSC Form 30



TIME INPUT FORM

General: This report is designed to provide (1) estimates of time intervals required to complete activities shown of PERT flow charts and (2) information on program progress. A separate report will be submitted for each PERT flow chart. Time interval estimates should be made by a person in highest level of the organization who could perform the work himself.

Submission: Reports will be submitted bi-weekly. Required timing will be specified at the time of installation of the PERT System for the component involved. Reports are required even though no significant developments occurred during the reporting period. Verbal reports will be accepted under unusual circumstances but must be confirmed with written reports.

Scope of Report: The following items will be reported on: (1)new activities, (2) deleted activities, (3) completed activities, (4) any activities for which the estimated completion times require revision, and (5) other changes listed under transaction codes for the activity cards.

Punch Card Instructions: First Card of a deck representing a network must be punched in the Initial Card Format and all succeeding cards must be in the Input Format for Activity Cards.

Initial Card Instructions

Column 1-7: Report Date (ddmmmyy) i.e., 07 JAN 62
8-9: Run Number - 01 - Initial Run
- 02 - 1st Update Run
- 03 - 2nd Update Run
10-11: Blank
12: Blank: No Master File Report printed
1: Master File Report printed
13-14: Month -
15-16: Day -
17-18: Year -
19: Blank: Does not include E-L Chart
1 ;Includes (D-E-D) L Chart by weeks. 2: Includes E-L Chart by weeks
20: Blank: No Summary Report
Letters A through O to indicate level of summary
21: Order of Event Output
Blank - No event output
1 - Event output ordered by event number
2 - Event output ordered by expected date
3 - 1 and 2
4 - Event output ordered by slack
5 - 1 and 4
6 - 2 and 4
7 - 1, 2 and 4
22: Blank
23: Blank - Include Run Date
1: Omit Run Date
24: Blank
25-26: Month -
27-28: Day -
29-30: Year -
31-36: System or Project Number
37-72: Output Heading
73-78: User's Symbol
79: Blank: Does not include E-L Chart. 1: Includes E-L Chart by months
80: Order of Activity Output
Blank - No Activity Output
1 - Activity Output ordered by ending/beginning event numbers
2 - Activity Output ordered by activity expected end time
3 - 1 and 2
4 - Activity Output listed by Activity Slack
5 - 1 and 4
6 - 2 and 4
7 - 1, 2 and 4

Input Format for Activity Cards

First Line (Mandatory)

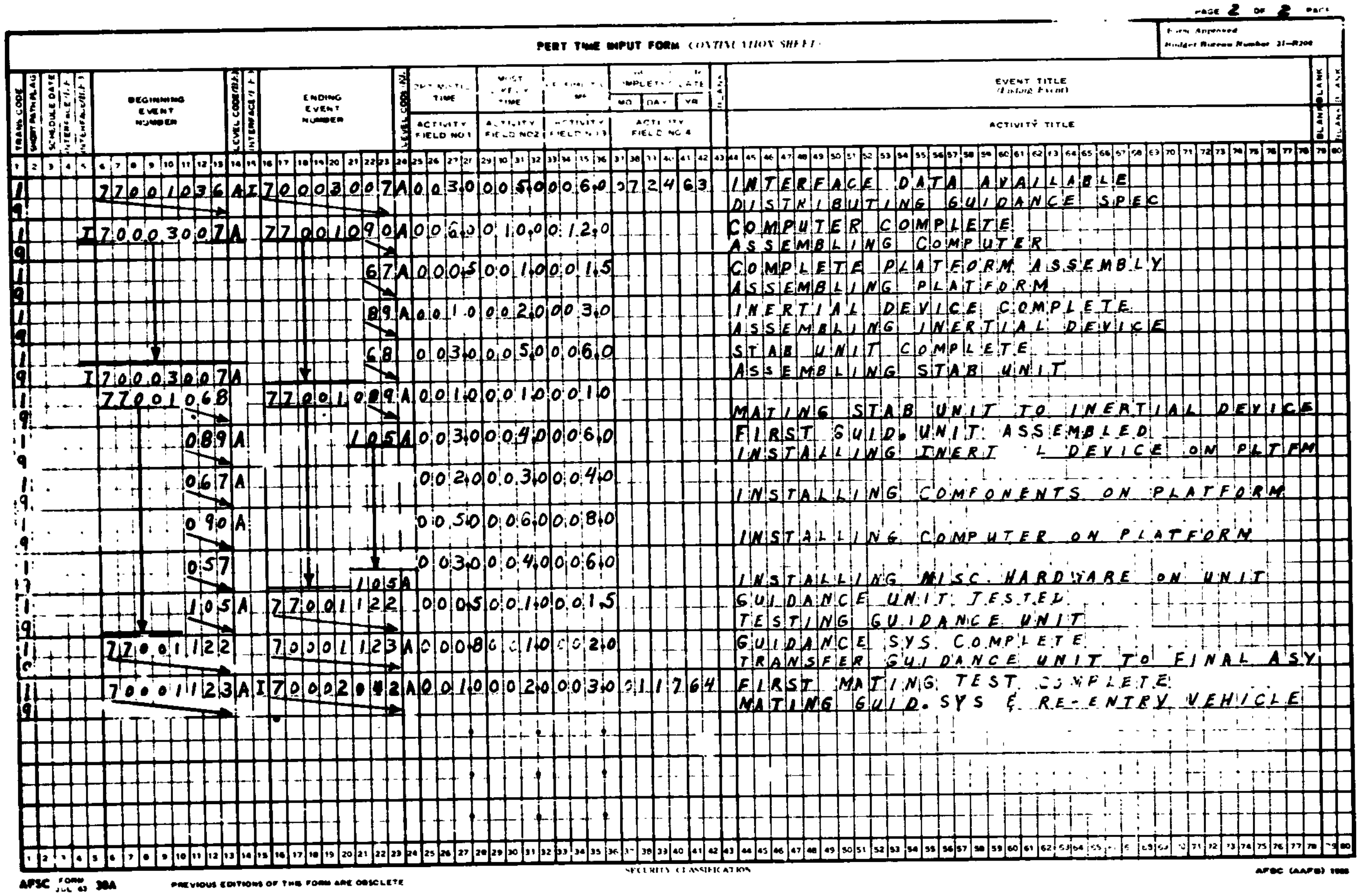
Column 1: Transaction Code
1 - Initial Entry
2 - Revised Time Estimates, change or delete Interface and Level Codes.
3 - Add, change, or delete scheduled date and/or scheduled date option: Add or change event title
4 - Activity Completion Date
5 - Deletion of an activity
6 - Add actual date and/or title to beginning events of network
7 - Not used
8 - Add or delete short path flag of an activity
9 - Used only on second line to add activity title and 18 columns of activity information
2: Blank: No short path flag
1 - Short path flag
3: Blank: Scheduled date option not used
1 - Scheduled date option used
4: Blank
5: Blank - Beginning event is not an interface
I - Beginning event is an interface
6-13: Beginning event number
14: Level code for beginning event number, letters A through O
15: Blank - Ending event is not an interface
I - Ending event is an interface
16-23: Ending event number
24: Level code for ending event number, letters A through O
25-28: Optimistic time in tenths of weeks (003.5 = 3 1/2 weeks) (leave blank for single time estimates)
29-32: Most likely time in tenths of weeks (use for either 1- or 3- time estimates)
33-36: Pessimistic time in tenths of weeks (leave blank for single time estimates)
37-38: Month
39-40: Day
41-42: Year
43: Must always be blank
44-78: Event title
79-80: Blank

NOTE: If single activity times are used, place in Columns 29 -32, "Most Likely Time Estimate."

Second Line(Optional)

Column 1: Transaction Code 9 must be used
2-4: Blank
5-24: Use same data as on first line.
25-28: Activity Field #1
29-32: Activity Field #2
33-36: Activity Field #3
37-42: Activity Field #4
43-78: Activity Title (Title may occupy columns 25-78 if activity fields are not used)
79-80: Blank

Figure A-5b
AFSC From 30 (instruction sheet)



PAGE 2 OF 2 PAGES

Form Approved
Budget Bureau Number 21-R200

PERT TIME INPUT FORM CONTINUATION SHEET

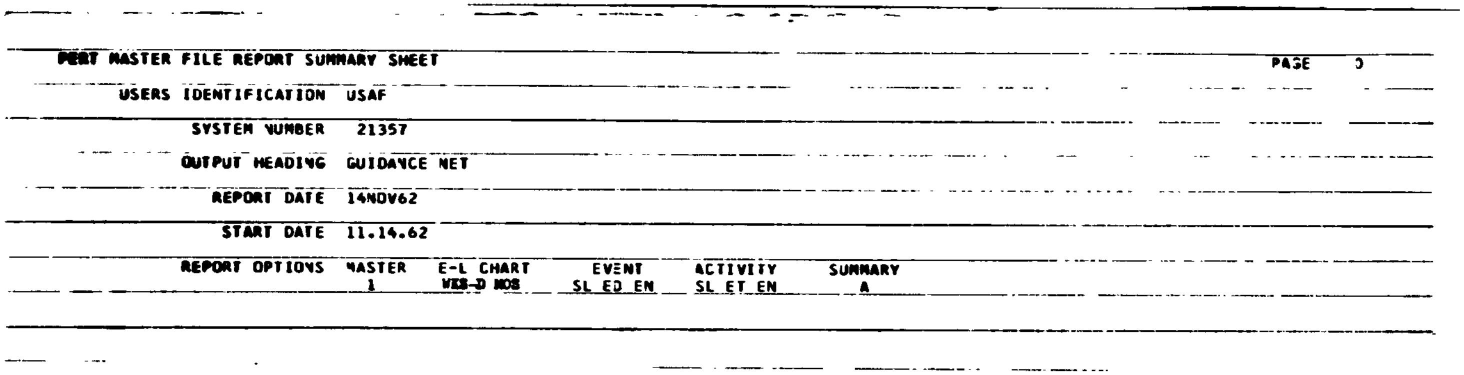
TRANS CODE	SHORT PATH FLAG	SCHEDULE DATE	INTERFACE	INTERFACE	BEGINNING EVENT NUMBER	LEVEL CODE	INTERFACE	ENDING EVENT NUMBER	LEVEL CODE	OPTIMISTIC TIME / ACTIVITY FIELD NO 1	MOST LIKELY TIME / ACTIVITY FIELD NO2	PESSIMISTIC / ACTIVITY FIELD NO 3	COMPLETION DATE MO DAY YR / ACTIVITY FIELD NO 4	BLANK	EVENT TITLE (Ending Event) / ACTIVITY TITLE
1					77001036	A	I	70003007	A	003.0	005.0	006.0	07 24 63		INTERFACE DATA AVAILABLE
9															DISTRIBUTING GUIDANCE SPEC
1				I	70003007	A		77001090	A	006.0	010.0	012.0			COMPUTER COMPLETE
9															ASSEMBLING COMPUTER
1								67	A	000.5	001.0	001.5			COMPLETE PLATFORM ASSEMBLY
9															ASSEMBLING PLATFORM
1								89	A	001.0	002.0	003.0			INERTIAL DEVICE COMPLETE
9															ASSEMBLING INERTIAL DEVICE
1								68		003.0	005.0	006.0			STAB UNIT COMPLETE
9				I	70003007	A									ASSEMBLING STAB UNIT
1					77001068			77001089	A	001.0	001.0	001.0			
9															MATING STAB UNIT TO INERTIAL DEVICE
1					089	A		105	A	003.0	004.0	006.0			FIRST GUID. UNIT ASSEMBLED
9															INSTALLING INERT L DEVICE ON PLTFM
1					067	A				002.0	003.0	004.0			
9															INSTALLING COMFONENTS ON PLATFORM
1					090	A				005.0	006.0	008.0			
9															INSTALLING COMPUTER ON PLATFORM
1					057					003.0	004.0	006.0			
9								105	A						INSTALLING MISC. HARDWARE ON UNIT
1					105	A		77001122		000.5	001.0	001.5			GUIDANCE UNIT TESTED
9															TESTING GUIDANCE UNIT
1					77001122			70001123	A	000.8	001.0	002.0			GUIDANCE SYS. COMPLETE
9															TRANSFER GUIDANCE UNIT TO FINAL ASY
1					70001123	A	I	70002042	A	001.0	002.0	003.0	01 17 64		FIRST MATING TEST COMPLETE
9															MATING GUID. SYS & RE-ENTRY VEHICLE

AFSC FORM JUL 63 30A PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

SECURITY CLASSIFICATION

AFSC (AAFB) 1965

Figure A-6
AFSC Form 30A



```
  PERT MASTER FILE REPORT SUMMARY SHEET                                                                  PAGE    3
          USERS IDENTIFICATION  USAF
                 SYSTEM NUMBER   21357
                OUTPUT HEADING  GUIDANCE NET
                   REPORT DATE  14NOV62
                    START DATE  11.14.62
                REPORT OPTIONS  MASTER   E-L CHART     EVENT     ACTIVITY    SUMMARY
                                  1       WKS-D NOS   SL ED EN   SL ET EN       A
```

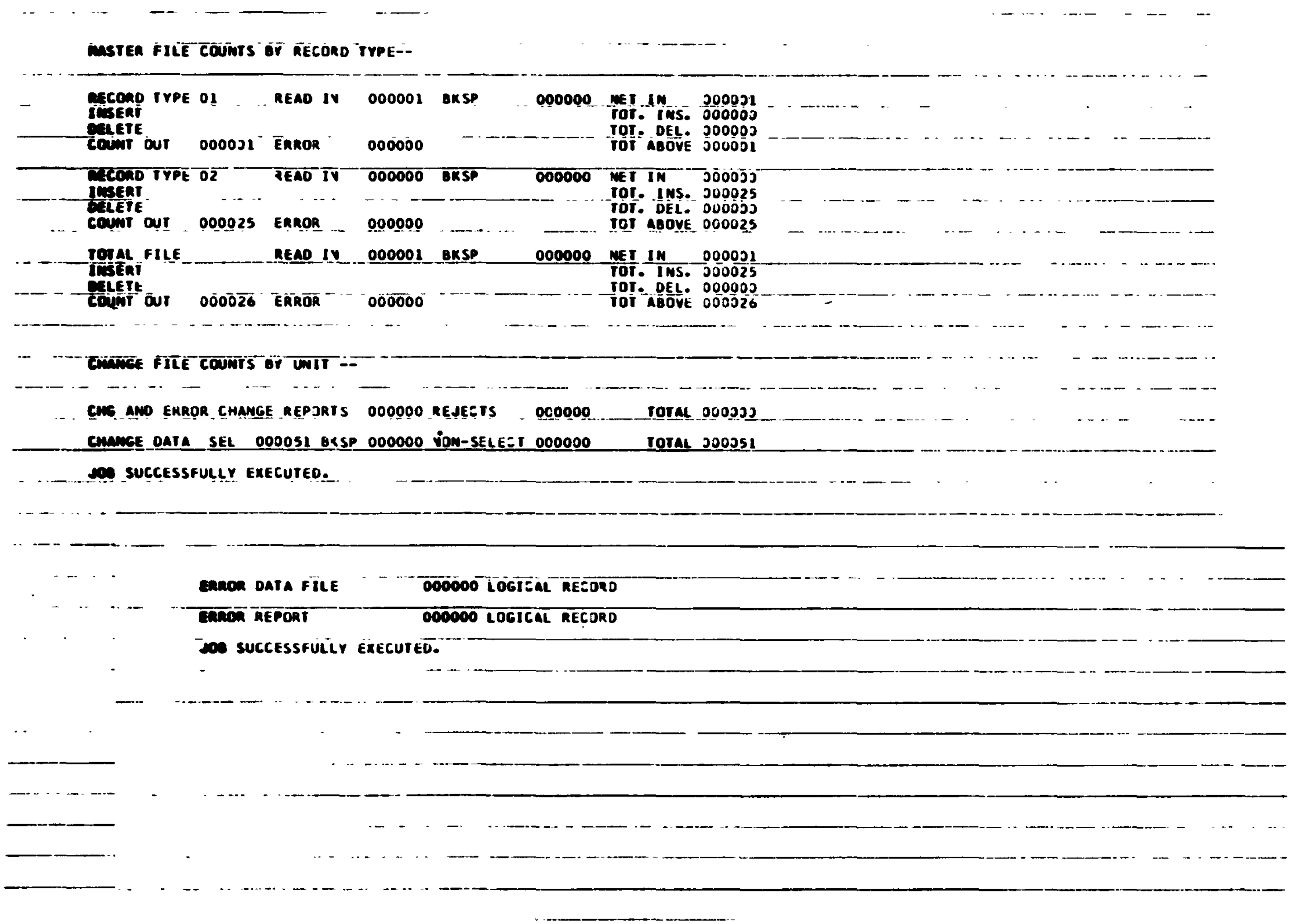
Figure A-7
Master File Report Summary Sheet

```
PERT MASTER FILE REPORT                                                                                    PAGE    1

TC  SP SCH   BEG EVENT LC   END EVENT LC  OPT TIME   MEAN  TIME    PESS TIME SCH DATE ACT DATE  EVENT TITLE
       OPT                                                                 / 1 / 2 / 3 / 4   /ACTIVITY TITLE

 3                          70.000.001 A                                    11.14.62         PROGRAM GO AHEAD
 1          70.000.001 A    70.001.000 A     1.0         2.0         3.0     1.30.63         START GUIDANCE ENGINEERING
                                                                                              AUTHORIZE GUIDANCE DIV TO START
 1          77.001.001      70.001.003       3.0         3.0         6.0                     PRELIMINARY SPEC COMPLETE
                                                                                              DETERMINING PRELIMINARY SPEC RQMTS
 1          77.001.002      70.001.003       1.0         2.0         3.0
                                                                                              ASSIGNING PERSONNEL
 1          77.001.122      70.001.123 A      .8         1.0         2.0                     GUIDANCE SYS COMPLETE
                                                                                              TRANSFER GUIDANCE UNIT TO FINAL ASY
 1          70.001.123 A   170.002.042 A     1.0         2.0         3.0     1.17.64         FIRST MATING TEST COMPLETE
                                                                                              MATING GUID SYS + RE-ENTRY VEHICLE
 1          77.001.036 A   170.003.007 A     3.0         5.0         6.0     7.24.63         INTERFACE DATA AVAILABLE
                                                                                              DISTRIBUTING GUIDANCE SPEC
 1          70.001.030 A    77.001.001       2.0         4.0         6.0                     ACCURACY RQMTS DETERMINED
                                                                                              DETERMINING REQUIREMENTS
 1          70.001.000 A    77.001.002       5.0         7.0         8.0                     MANNING COMPLETE
                                                                                              MANNING DESIGN UNIT
 1          70.001.003      77.001.004       5.0         6.0         8.0                     DESIGN DATA COMPLETE
                                                                                              DETERMINING FINAL DESIGN DATA
 1          70.001.000      77.001.005       8.0         8.0         8.0                     SPEC PARAMETERS COMPLETE
                                                                                              DETERMINING SPEC PARAMETERS
 1          77.001.004      77.001.005       6.0        11.0        15.0
                                                                                              PREPARE SPEC PARAMETERS
 1          77.001.005      77.001.025       6.0        11.0        15.0                     GUIDANCE SPEC DRAFT APPROVED
                                                                                              REVIEWING DRAFT OF GUIDANCE SPEC
 1          77.001.025      77.001.036 A     1.0         3.0         4.0                     GUIDANCE SPEC COMPLETE
                                                                                              PRINT GUIDANCE SPEC
 1          70.001.033      77.001.057      11.0        18.0        21.0                     MISC HARDWARE AVAILABLE
                                                                                              PROCURING HARDWARE
 1          70.003.007 A    77.001.067 A      .5         1.0         1.5                     COMPLETE PLATFORM ASSEMBLY
                                                                                              ASSEMBLING PLATFORM
 1          70.003.007 A    77.001.068       3.0         5.0         6.0                     STAB UNIT COMPLETE
                                                                                              ASSEMBLING STAB UNIT
 1          70.003.007 A    77.001.089 A     1.0         2.0         3.0                     INERTIAL DEVICE COMPLETE
                                                                                              ASSEMBLING INERTIAL DEVICE
 1          77.001.068      77.001.089 A     1.0         1.0         1.0
                                                                                              MATING STAB UNIT TO INERTIAL DEVICE
 1         170.003.007 A    77.001.090 A     6.0        10.0        12.0                     COMPUTER COMPLETE
                                                                                              ASSEMBLING COMPUTER
 1          77.001.057      77.001.105 A     3.0         4.0         6.0
                                                                                              INSTALLING MISC HARDWARE ON UNIT
 1          77.001.067 A    77.001.105 A     2.0         3.0         4.0
                                                                                              INSTALLING COMPONENTS ON PLATFORM
 1          77.001.089 A    77.001.105 A     3.0         4.0         6.0                     FIRST GUID.UNIT ASSEMBLED
                                                                                              INSTALLING INERTIAL DEVICE ON PLTFM
 1          77.001.090 A    77.001.105 A     5.0         6.0         8.0
                                                                                              INSTALLING COMPUTER ON PLATFORM
 1          77.001.105 A    77.001.122        .5         1.0         1.5                     GUIDANCE UNIT TESTED
                                                                                              TESTING GUIDANCE UNIT
```

Figure A-8
PERT Master File Report



```
MASTER FILE COUNTS BY RECORD TYPE--

RECORD TYPE 01        READ IN   000001  BKSP      000000  NET IN     000001
INSERT                                                    TOT. INS.  000000
DELETE                                                    TOT. DEL.  000000
COUNT OUT    000001   ERROR     000000                    TOT ABOVE  000001

RECORD TYPE 02        READ IN   000000  BKSP      000000  NET IN     000000
INSERT                                                    TOT. INS.  000025
DELETE                                                    TOT. DEL.  000000
COUNT OUT    000025   ERROR     000000                    TOT ABOVE  000025

TOTAL FILE            READ IN   000001  BKSP      000000  NET IN     000001
INSERT                                                    TOT. INS.  000025
DELETE                                                    TOT. DEL.  000000
COUNT OUT    000026   ERROR     000000                    TOT ABOVE  000026


CHANGE FILE COUNTS BY UNIT --

CHG AND ERROR CHANGE REPORTS  000000 REJECTS     000000      TOTAL 000000

CHANGE DATA  SEL  000051 BKSP 000000 NON-SELECT 000000       TOTAL 000051

JOB SUCCESSFULLY EXECUTED.



               ERROR DATA FILE        000000 LOGICAL RECORD

               ERROR REPORT           000000 LOGICAL RECORD

               JOB SUCCESSFULLY EXECUTED.
```

Figure A-9
Report of Updated Activities
(for use by the DPA)

```
SYSTEM NO.  21357       EVENT REPORT        GUIDANCE NET                                        RUN NO. 01             PAGE NO.    1 EVENT
START DATE 14NOV62                          USAF PERT                                        19 EVENTS                 USAF
END DATE    17JAN64                         RUN DATE                                         24 ACTIVITIES             REPORT DATE 14NOV62

    EVENT                            EVENT       L  CRITICAL    L  S  ACTUAL  EXPECTED  LATEST    SCHEDULED  SLACK     STD  PROB PROB
    TITLE                            NO.         C  PREDECESSOR C  P  DATE    DATE      DATE      DATE       TIME      DEV  SCD POS SL
PROGRAM GO AHEAD                     70-000-001  A                            14NOV62   28SEP62              -  6.6    .0          .01
START GUIDANCE ENGINEERING           70-001-000  A  70-000-001  A             28NOV62   12OCT62   30JAN63    -  6.6    .3   1.00   .01
PRELIMINARY SPEC COMPLETE            70-001-003     77-001-002                01FEB63   14DEC62              -  6.6    .7          .01
GUIDANCE SYS COMPLETE                70-001-123  A  77-001-122                19FEB64   03JAN64              -  6.6   2.7          .01
FIRST MATING TEST COMPLETE          170-002-042  A  70-001-123  A             04MAR64   17JAN64   17JAN64    -  6.6   2.7    .01   .01
INTERFACE DATA AVAILABLE            170-003-007  A  77-001-036  A             11OCT63   26AUG63   24JUL63    -  6.6   2.5    .00   .01
ACCURACY RQMTS DETERMINED            77-001-001     70-001-000  A             28DEC62   20NOV62              -  5.3    .8          .02
MANNING COMPLETE                     77-001-002     70-001-000  A             18JAN63   30NOV62              -  6.6    .6          .01
DESIGN DATA COMPLETE                 77-001-004     70-001-003                18MAR63   30JAN63              -  6.6    .9          .01
SPEC PARAMETERS COMPLETE             77-001-005     77-001-004                03JUN63   16APR63              -  6.6   1.7          .01
GUIDANCE SPEC DRAFT APPROVED         77-001-025     77-001-005                19AUG63   02JUL63              -  6.6   2.3          .01
GUIDANCE SPEC COMPLETE               77-001-036  A  77-001-025                09SEP63   23JUL63              -  6.6   2.4          .01
MISC HARDWARE AVAILABLE              77-001-057     70-001-003                05JUN63   18NOV63                23.2   1.8         1.00
COMPLETE PLATFORM ASSEMBLY           77-001-067  A  70-003-007  A             18OCT63   26NOV63                 5.3   2.5          .98
STAB UNIT COMPLETE                   77-001-068     70-003-007  A             14NOV63   11NOV63              -   .7   2.5          .60
INERTIAL DEVICE COMPLETE             77-001-089  A  77-001-068                21NOV63   18NOV63              -   .7   2.5          .40
COMPUTER COMPLETE                    77-001-090  A  70-003-007  A             20DEC63   04NOV63              -  6.6   2.7          .01
FIRST GUID.UNIT ASSEMBLED            77-001-105  A  77-001-090  A             05FEB64   18DEC63              -  6.6   2.7          .01
GUIDANCE UNIT TESTED                 77-001-122     77-001-105  A             12FEB64   26DEC63              -  6.6   2.7          .01
```

Figure A-10
Event Report-Event Number Sequence

```
SYSTEM NO.  21357      EVENT REPORT        GUIDANCE NET                                  RUN NO. 01           PAGE NO.   1 EDATE
START DATE 14NOV62                         USAF PERT                                 19 EVENTS              JSAF
END DATE    17JAN64                        RUN DATE                                  24 ACTIVITIES          REPORT DATE 14NOV62

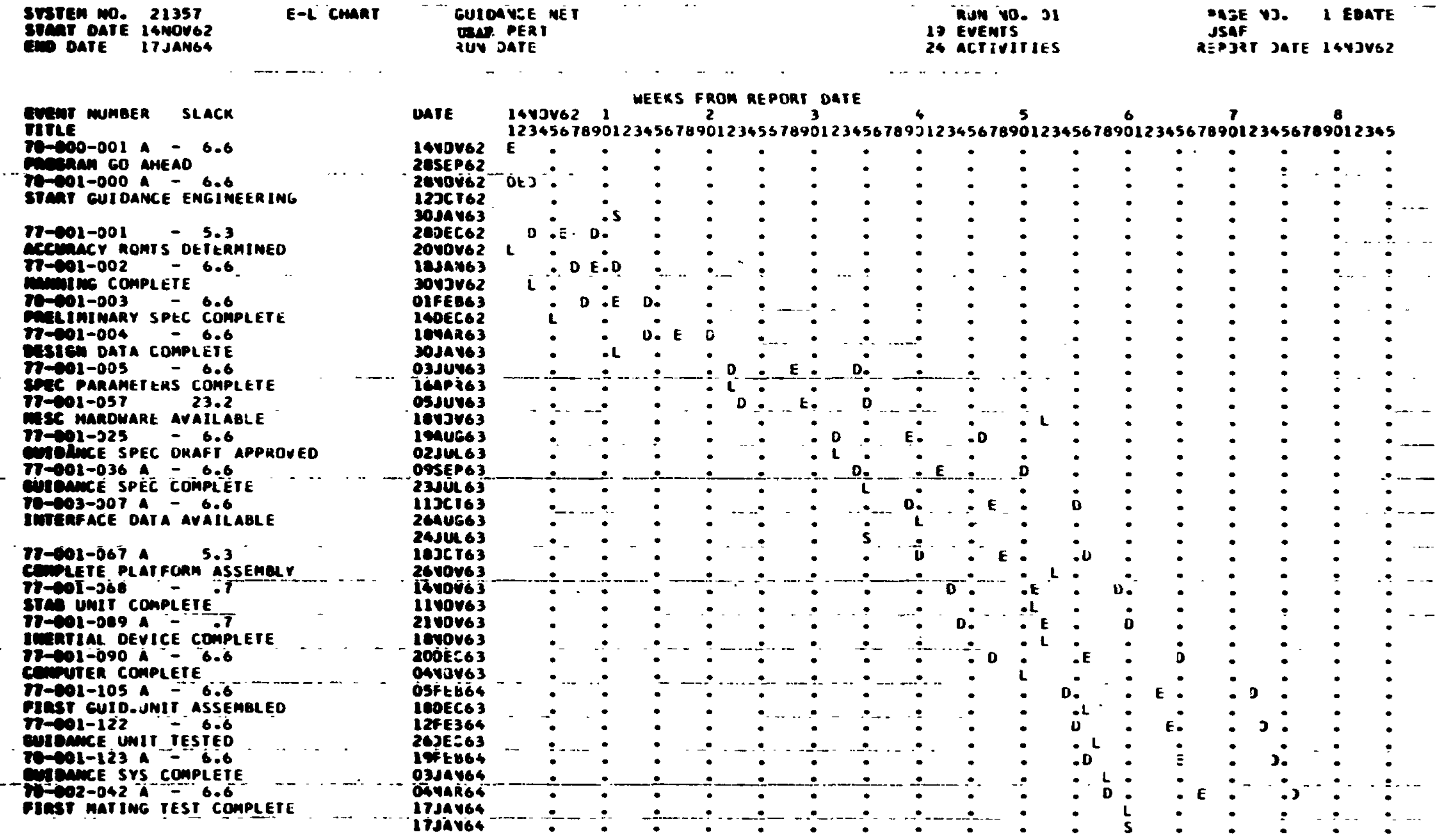
    EVENT                                  EVENT       L  CRITICAL     L  S  ACTUAL   EXPECTED  LATEST   SCHEDULED  SLACK    STD  PROB PROB
    TITLE                                  NO.         C  PREDECESSOR  C  P  DATE     DATE      DATE     DATE       TIME     DEV  SCD  POS SL
PROGRAM GO AHEAD                           70-000-001  A                              14NOV62   28SEP62             -  6.6   .0          .01
START GUIDANCE ENGINEERING                 70-001-000  A  70-000-001   A              28NOV62   12OCT62  30JAN63    -  6.6   .3   1.00   .01
ACCURACY RQMTS DETERMINED                  77-001-001     70-001-000   A              28DEC62   20NOV62             -  5.3   .8          .02
MANNING COMPLETE                           77-001-002     70-001-000   A              18JAN63   30NOV62             -  6.6   .6          .01
PRELIMINARY SPEC COMPLETE                  70-001-003     77-001-002                  01FEB63   14DEC62             -  6.6   .7          .01
DESIGN DATA COMPLETE                       77-001-004     70-001-003                  19MAR63   30JAN63             -  6.6   .9          .01
SPEC PARAMETERS COMPLETE                   77-001-005     77-001-004                  03JUN63   16APR63             -  6.6  1.7          .01
MISC HARDWARE AVAILABLE                    77-001-057     70-001-003                  05JUN63   18NOV63               23.2  1.8         1.00
GUIDANCE SPEC DRAFT APPROVED               77-001-025     77-001-005                  19AUG63   02JUL63             -  6.6  2.3          .01
GUIDANCE SPEC COMPLETE                     77-001-036  A  77-001-025                  09SEP63   23JUL63             -  6.6  2.4          .01
INTERFACE DATA AVAILABLE                  170-003-007  A  77-001-036   A              11OCT63   26AUG63  24JUL63    -  6.5  2.5   .00    .01
COMPLETE PLATFORM ASSEMBLY                 77-001-067  A  70-003-007   A              18OCT63   26NOV63                5.3  2.5          .98
STAB UNIT COMPLETE                         77-001-068     70-003-007   A              14NOV63   11NOV63             -   .7  2.5          .40
INERTIAL DEVICE COMPLETE                   77-001-089  A  77-001-068                  21NOV63   18NOV63             -   .7  2.5          .40
COMPUTER COMPLETE                          77-001-090  A  70-003-007   A              20DEC63   04NOV63             -  6.5  2.7          .01
FIRST GUID.UNIT ASSEMBLED                  77-001-105  A  77-001-090   A              05FEB64   18DEC63             -  6.6  2.7          .01
GUIDANCE UNIT TESTED                       77-001-122     77-001-105   A              12FEB64   26DEC63             -  6.6  2.7          .01
GUIDANCE SYS COMPLETE                      70-001-123  A  77-001-122                  19FEB64   03JAN64             -  6.6  2.7          .01
FIRST MATING TEST COMPLETE                170-002-042  A  70-001-123   A              04MAR64   17JAN64  17JAN64    -  6.5  2.7   .01    .01
```

Figure A-11
Event Report-Expected Date Sequence

```
SYSTEM NO.  21357      EVENT REPORT       GUIDANCE NET                                  RUN NO. 01              PAGE NO.   1 SLACK
START DATE 14NOV62                         USAF PERT                                   19 EVENTS               USAF
END DATE   17JAN64                         RUN DATE                                    24 ACTIVITIES           REPORT DATE 14NOV62

    EVENT                                  EVENT       L  CRITICAL    L  S  ACTUAL  EXPECTED  LATEST   SCHEDULED  SLACK   STD  PROB PROB
    TITLE                                  NO.         C PREDECESSOR  C  P  DATE    DATE      DATE     DATE       TIME    DEV  SCD  POS SL
PROGRAM GO AHEAD                           70-000-001 A                             14NOV62   28SEP62             - 6.6    .0         .01
START GUIDANCE ENGINEERING                 70-001-000 A  70-000-001 A               28NOV62   12OCT62  30JAN63    - 6.6    .3  1.00   .01
GUIDANCE UNIT TESTED                       77-001-122    77-001-105 A               12FEB64   26DEC63             - 5.6   2.7         .01
MANNING COMPLETE                           77-001-002    70-001-000 A               18JAN63   30NOV62             - 6.6    .6         .01
PRELIMINARY SPEC COMPLETE                  70-001-003    77-001-002                 01FEB63   14DEC62             - 6.6    .7         .01
DESIGN DATA COMPLETE                       77-001-004    70-001-003                 18MAR63   30JAN63             - 6.6    .9         .01
SPEC PARAMETERS COMPLETE                   77-001-005    77-001-004                 03JUN63   16APR63             - 6.6   1.7         .01
FIRST MATING TEST COMPLETE                170-002-042 A  70-001-123 A               04MAR64   17JAN64  17JAN64    - 6.6   2.7   .01   .01
GUIDANCE SPEC DRAFT APPROVED               77-001-025    77-001-005                 19AUG63   02JUL63             - 6.6   2.3         .01
GUIDANCE SPEC COMPLETE                     77-001-036 A  77-001-025                 09SEP63   23JUL63             - 5.6   2.4         .01
INTERFACE DATA AVAILABLE                  170-003-007 A  77-001-036 A               11OCT63   26AUG63  24JUL63    - 5.6   2.5   .00   .01
GUIDANCE SYS COMPLETE                      70-001-123 A  77-001-122                 19FEB64   03JAN64             - 6.6   2.7         .01
FIRST GUID.UNIT ASSEMBLED                  77-001-105 A  77-001-090 A               05FEB64   18DEC63             - 6.6   2.7         .01
COMPUTER COMPLETE                          77-001-090 A  70-003-007 A               20DEC63   04NOV63             - 6.6   2.7         .01
ACCURACY RQMTS DETERMINED                  77-001-001    70-001-000 A               28DEC62   20NOV62             - 5.3    .8         .02
STAB UNIT COMPLETE                         77-001-068    70-003-007 A               14NOV63   11NOV63             -  .7   2.5         .40
INERTIAL DEVICE COMPLETE                   77-001-089 A  77-001-068                 21NOV63   18NOV63             -  .7   2.5         .40
COMPLETE PLATFORM ASSEMBLY                 77-001-067 A  70-003-007 A               18OCT63   26NOV63                5.3  2.5         .98
MISC HARDWARE AVAILABLE                    77-001-057    70-001-003                 05JUN63   18NOV63               23.2  1.8        1.00
```

Figure A-12
Event Report-Slack Sequence



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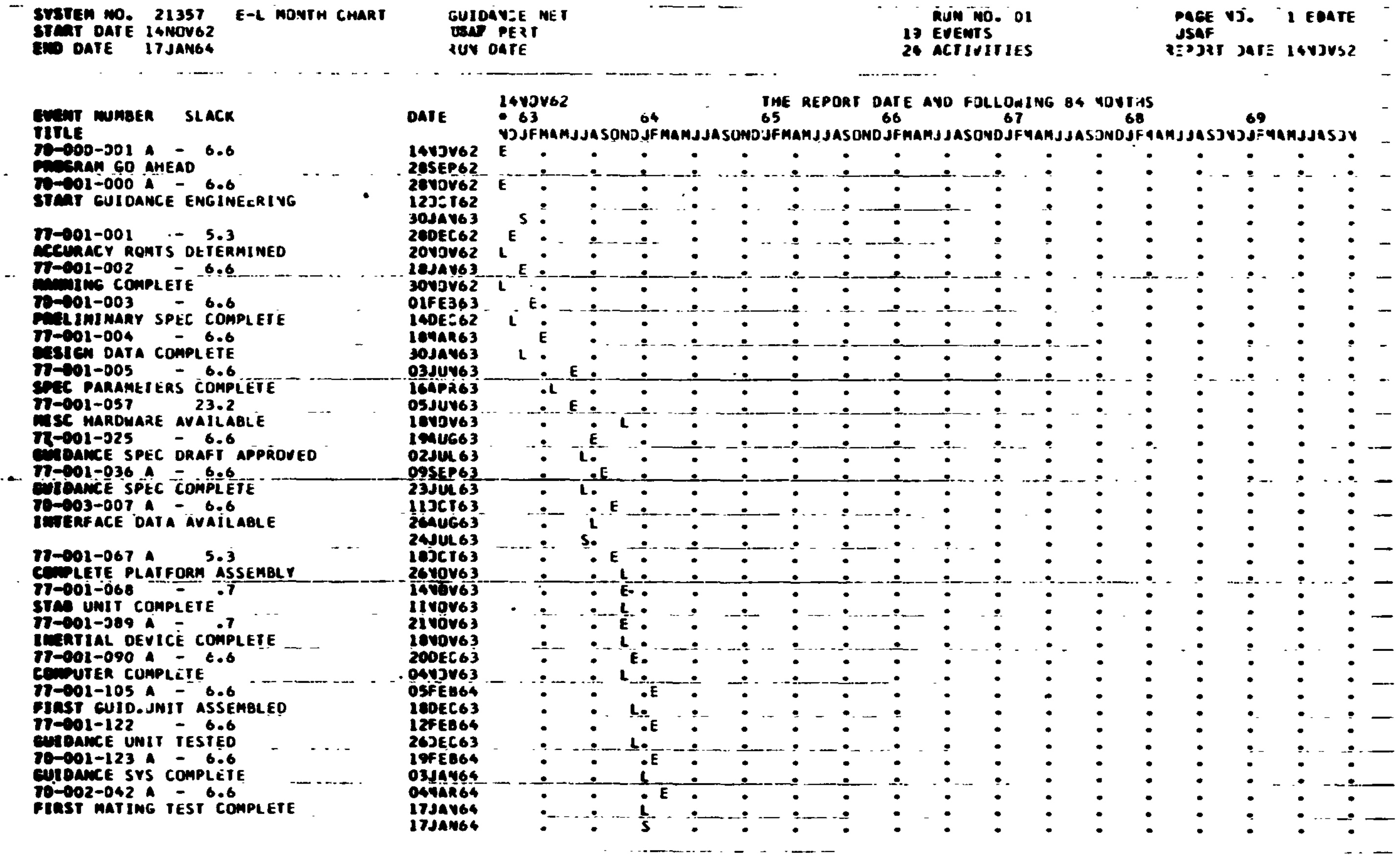
SYSTEM NO.  21357        E-L CHART        GUIDANCE NET                          RUN NO. 01          PAGE NO.   1 EDATE
START DATE 14NOV62                        USAF PERT                          19 EVENTS              JSAF
END DATE    17JAN64                       RUN DATE                           24 ACTIVITIES          REPORT DATE 14NOV62

                                                            WEEKS FROM REPORT DATE
EVENT NUMBER   SLACK                 DATE     14NOV62  1         2         3         4         5         6         7         8
TITLE                                         12345678901234567890123455789012345678901234567890123456789012345678901234567890123451
70-000-001 A  -  6.6                 14NOV62
PROGRAM GO AHEAD                     28SEP62
70-001-000 A  -  6.6                 28NOV62
START GUIDANCE ENGINEERING           12OCT62
                                     30JAN63
77-001-001    -  5.3                 28DEC62
ACCURACY RQMTS DETERMINED            20NOV62
77-001-002    -  6.6                 18JAN63
MANNING COMPLETE                     30NOV62
70-001-003    -  6.6                 01FEB63
PRELIMINARY SPEC COMPLETE            14DEC62
77-001-004    -  6.6                 18MAR63
DESIGN DATA COMPLETE                 30JAN63
77-001-005    -  6.6                 03JUN63
SPEC PARAMETERS COMPLETE             16APR63
77-001-057       23.2                05JUN63
MESC HARDWARE AVAILABLE              18NOV63
77-001-025    -  6.6                 19AUG63
GUIDANCE SPEC DRAFT APPROVED         02JUL63
77-001-036 A  -  6.6                 09SEP63
GUIDANCE SPEC COMPLETE               23JUL63
70-003-007 A  -  6.6                 11OCT63
INTERFACE DATA AVAILABLE             26AUG63
                                     24JUL63
77-001-067 A     5.3                 18OCT63
COMPLETE PLATFORM ASSEMBLY           26NOV63
77-001-068    -   .7                 14NOV63
STAB UNIT COMPLETE                   11NOV63
77-001-089 A  -   .7                 21NOV63
INERTIAL DEVICE COMPLETE             18NOV63
77-001-090 A  -  6.6                 20DEC63
COMPUTER COMPLETE                    04NOV63
77-001-105 A  -  6.6                 05FEB64
FIRST GUID.UNIT ASSEMBLED            18DEC63
77-001-122    -  6.6                 12FEB64
GUIDANCE UNIT TESTED                 26DEC63
70-001-123 A  -  6.6                 19FEB64
GUIDANCE SYS COMPLETE                03JAN64
70-002-042 A  -  6.6                 04MAR64
FIRST MATING TEST COMPLETE           17JAN64
                                     17JAN64
```

Figure A-13
E-L Chart (Weeks)



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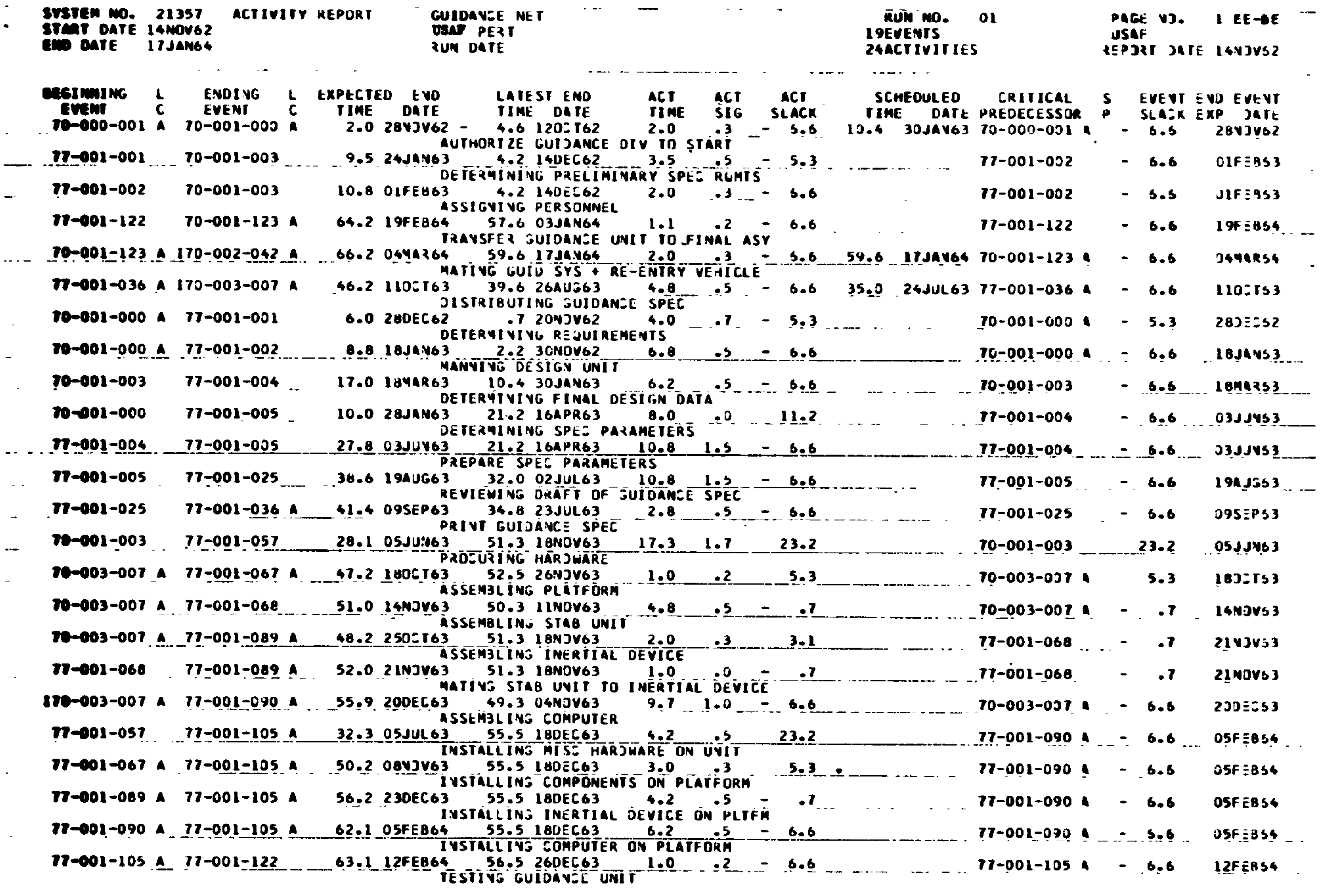
SYSTEM NO.  21357   E-L MONTH CHART     GUIDANCE NET                                 RUN NO. 01                 PAGE NO.    1 EDATE
START DATE 14NOV62                       USAF PERT                                 19 EVENTS                    JSAF
END DATE    17JAN64                      RUN DATE                                  24 ACTIVITIES                REPORT DATE 14NOV52

                                             14NOV62                 THE REPORT DATE AND FOLLOWING 84 MONTHS
EVENT NUMBER   SLACK                 DATE    • 63          64          65          66          67          68          69
TITLE                                        NDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASON
70-000-001 A  -  6.6                 14NOV62 E   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
PROGRAM GO AHEAD                     28SEP62     .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
70-001-000 A  -  6.6                 28NOV62 E   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
START GUIDANCE ENGINEERING           12OCT62     .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
                                     30JAN63   S .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-001    -  5.3                 28DEC62  E  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
ACCURACY RQMTS DETERMINED            20NOV62 L   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-002    -  6.6                 18JAN63   E .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
MANNING COMPLETE                     30NOV62 L   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
70-001-003    -  6.6                 01FEB63    E.    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
PRELIMINARY SPEC COMPLETE            14DEC62  L  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-004    -  6.6                 18MAR63     E    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
DESIGN DATA COMPLETE                 30JAN63   L .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-005    -  6.6                 03JUN63     .  E .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
SPEC PARAMETERS COMPLETE             16APR63     .L   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-057       23.2                05JUN63     .  E .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
MISC HARDWARE AVAILABLE              18NOV63     .    .  L .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-025    -  6.6                 19AUG63     .    E    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
GUIDANCE SPEC DRAFT APPROVED         02JUL63     .   L.    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-036 A  -  6.6                 09SEP63     .    .E   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
GUIDANCE SPEC COMPLETE               23JUL63     .   L.    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
70-003-007 A  -  6.6                 11OCT63     .    . E  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
INTERFACE DATA AVAILABLE             26AUG63     .    L    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
                                     24JUL63     .   S.    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-067 A     5.3                 18OCT63     .    . E  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
COMPLETE PLATFORM ASSEMBLY           26NOV63     .    .  L .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-068    -   .7                 14NOV63     .    .  E-.    .    .    .    .    .    .    .    .    .    .    .    .    .    .
STAB UNIT COMPLETE                   11NOV63     .    .  L .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-089 A  -   .7                 21NOV63     .    .  E .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
INERTIAL DEVICE COMPLETE             18NOV63     .    .  L .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-090 A  -  6.6                 20DEC63     .    .   E.    .    .    .    .    .    .    .    .    .    .    .    .    .    .
COMPUTER COMPLETE                    04NOV63     .    .  L .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-105 A  -  6.6                 05FEB64     .    .    .E   .    .    .    .    .    .    .    .    .    .    .    .    .    .
FIRST GUID.UNIT ASSEMBLED            18DEC63     .    .   L.    .    .    .    .    .    .    .    .    .    .    .    .    .    .
77-001-122    -  6.6                 12FEB64     .    .    .E   .    .    .    .    .    .    .    .    .    .    .    .    .    .
GUIDANCE UNIT TESTED                 26DEC63     .    .   L.    .    .    .    .    .    .    .    .    .    .    .    .    .    .
70-001-123 A  -  6.6                 19FEB64     .    .    .E   .    .    .    .    .    .    .    .    .    .    .    .    .    .
GUIDANCE SYS COMPLETE                03JAN64     .    .    L    .    .    .    .    .    .    .    .    .    .    .    .    .    .
70-002-042 A  -  6.6                 04MAR64     .    .    . E  .    .    .    .    .    .    .    .    .    .    .    .    .    .
FIRST MATING TEST COMPLETE           17JAN64     .    .    L    .    .    .    .    .    .    .    .    .    .    .    .    .    .
                                     17JAN64     .    .    S    .    .    .    .    .    .    .    .    .    .    .    .    .    .
```

Figure A-14
E-L Chart (Months)



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SYSTEM NO.  21357   ACTIVITY REPORT      GUIDANCE NET                                        RUN NO.   01            PAGE NO.   1 EE-BE
START DATE 14NOV62                       USAF PERT                                           19EVENTS                USAF
END DATE   17JAN64                       RUN DATE                                            24ACTIVITIES            REPORT DATE 14NOV62

BEGINNING   L    ENDING    L  EXPECTED  END      LATEST END      ACT    ACT    ACT     SCHEDULED     CRITICAL     S   EVENT END EVENT
  EVENT     C    EVENT     C    TIME   DATE      TIME  DATE      TIME   SIG   SLACK    TIME   DATE  PREDECESSOR   P   SLACK EXP  DATE
 70-000-001 A  70-001-000 A     2.0 28NOV62 -   4.6 12OCT62     2.0    .3  -  5.6   10.4  30JAN63 70-000-001 A   -   6.6    28NOV62
                                          AUTHORIZE GUIDANCE DIV TO START
 77-001-001    70-001-003       9.5 24JAN63     4.2 14DEC62     3.5    .5  -  5.3                 77-001-002     -   6.6    01FEB63
                                          DETERMINING PRELIMINARY SPEC RQMTS
 77-001-002    70-001-003      10.8 01FEB63     4.2 14DEC62     2.0    .3  -  6.6                 77-001-002     -   6.6    01FEB63
                                          ASSIGNING PERSONNEL
 77-001-122    70-001-123 A    64.2 19FEB64    57.6 03JAN64     1.1    .2  -  6.6                 77-001-122     -   6.6    19FEB64
                                          TRANSFER GUIDANCE UNIT TO FINAL ASY
 70-001-123 A 170-002-042 A    66.2 04MAR64    59.6 17JAN64     2.0    .3  -  6.6   59.6  17JAN64 70-001-123 A   -   6.6    04MAR64
                                          MATING GUID SYS + RE-ENTRY VEHICLE
 77-001-036 A 170-003-007 A    46.2 11OCT63    39.6 26AUG63     4.8    .5  -  6.6   35.0  24JUL63 77-001-036 A   -   6.6    11OCT63
                                          DISTRIBUTING GUIDANCE SPEC
 70-001-000 A  77-001-001       6.0 28DEC62      .7 20NOV62     4.0    .7  -  5.3                 70-001-000 A   -   5.3    28DEC62
                                          DETERMINING REQUIREMENTS
 70-001-000 A  77-001-002       8.8 18JAN63     2.2 30NOV62     6.8    .5  -  6.6                 70-001-000 A   -   6.6    18JAN63
                                          MANNING DESIGN UNIT
 70-001-003    77-001-004      17.0 18MAR63    10.4 30JAN63     6.2    .5  -  6.6                 70-001-003     -   6.6    18MAR63
                                          DETERMINING FINAL DESIGN DATA
 70-001-000    77-001-005      10.0 28JAN63    21.2 16APR63     8.0    .0    11.2                 77-001-004     -   6.6    03JUN63
                                          DETERMINING SPEC PARAMETERS
 77-001-004    77-001-005      27.8 03JUN63    21.2 16APR63    10.8   1.5  -  6.6                 77-001-004     -   6.6    03JUN63
                                          PREPARE SPEC PARAMETERS
 77-001-005    77-001-025      38.6 19AUG63    32.0 02JUL63    10.8   1.5  -  6.6                 77-001-005     -   6.6    19AUG63
                                          REVIEWING DRAFT OF GUIDANCE SPEC
 77-001-025    77-001-036 A    41.4 09SEP63    34.8 23JUL63     2.8    .5  -  6.6                 77-001-025     -   6.6    09SEP63
                                          PRINT GUIDANCE SPEC
 70-001-003    77-001-057      28.1 05JUN63    51.3 18NOV63    17.3   1.7    23.2                 70-001-003        23.2    05JUN63
                                          PROCURING HARDWARE
 70-003-007 A  77-001-067 A    47.2 18OCT63    52.5 26NOV63     1.0    .2     5.3                 70-003-007 A       5.3    18OCT63
                                          ASSEMBLING PLATFORM
 70-003-007 A  77-001-068      51.0 14NOV63    50.3 11NOV63     4.8    .5  -   .7                 70-003-007 A   -    .7    14NOV63
                                          ASSEMBLING STAB UNIT
 70-003-007 A  77-001-089 A    48.2 25OCT63    51.3 18NOV63     2.0    .3     3.1                 77-001-068     -    .7    21NOV63
                                          ASSEMBLING INERTIAL DEVICE
 77-001-068    77-001-089 A    52.0 21NOV63    51.3 18NOV63     1.0    .0  -   .7                 77-001-068     -    .7    21NOV63
                                          MATING STAB UNIT TO INERTIAL DEVICE
170-003-007 A  77-001-090 A    55.9 20DEC63    49.3 04NOV63     9.7   1.0  -  6.6                 70-003-007 A   -   6.6    20DEC63
                                          ASSEMBLING COMPUTER
 77-001-057    77-001-105 A    32.3 05JUL63    55.5 18DEC63     4.2    .5    23.2                 77-001-090 A   -   6.6    05FEB64
                                          INSTALLING MISC HARDWARE ON UNIT
 77-001-067 A  77-001-105 A    50.2 08NOV63    55.5 18DEC63     3.0    .3     5.3                 77-001-090 A   -   6.6    05FEB64
                                          INSTALLING COMPONENTS ON PLATFORM
 77-001-089 A  77-001-105 A    56.2 23DEC63    55.5 18DEC63     4.2    .5  -   .7                 77-001-090 A   -   6.6    05FEB64
                                          INSTALLING INERTIAL DEVICE ON PLTFM
 77-001-090 A  77-001-105 A    62.1 05FEB64    55.5 18DEC63     6.2    .5  -  6.6                 77-001-090 A   -   5.6    05FEB64
                                          INSTALLING COMPUTER ON PLATFORM
 77-001-105 A  77-001-122      63.1 12FEB64    56.5 26DEC63     1.0    .2  -  6.6                 77-001-105 A   -   6.6    12FEB64
                                          TESTING GUIDANCE UNIT
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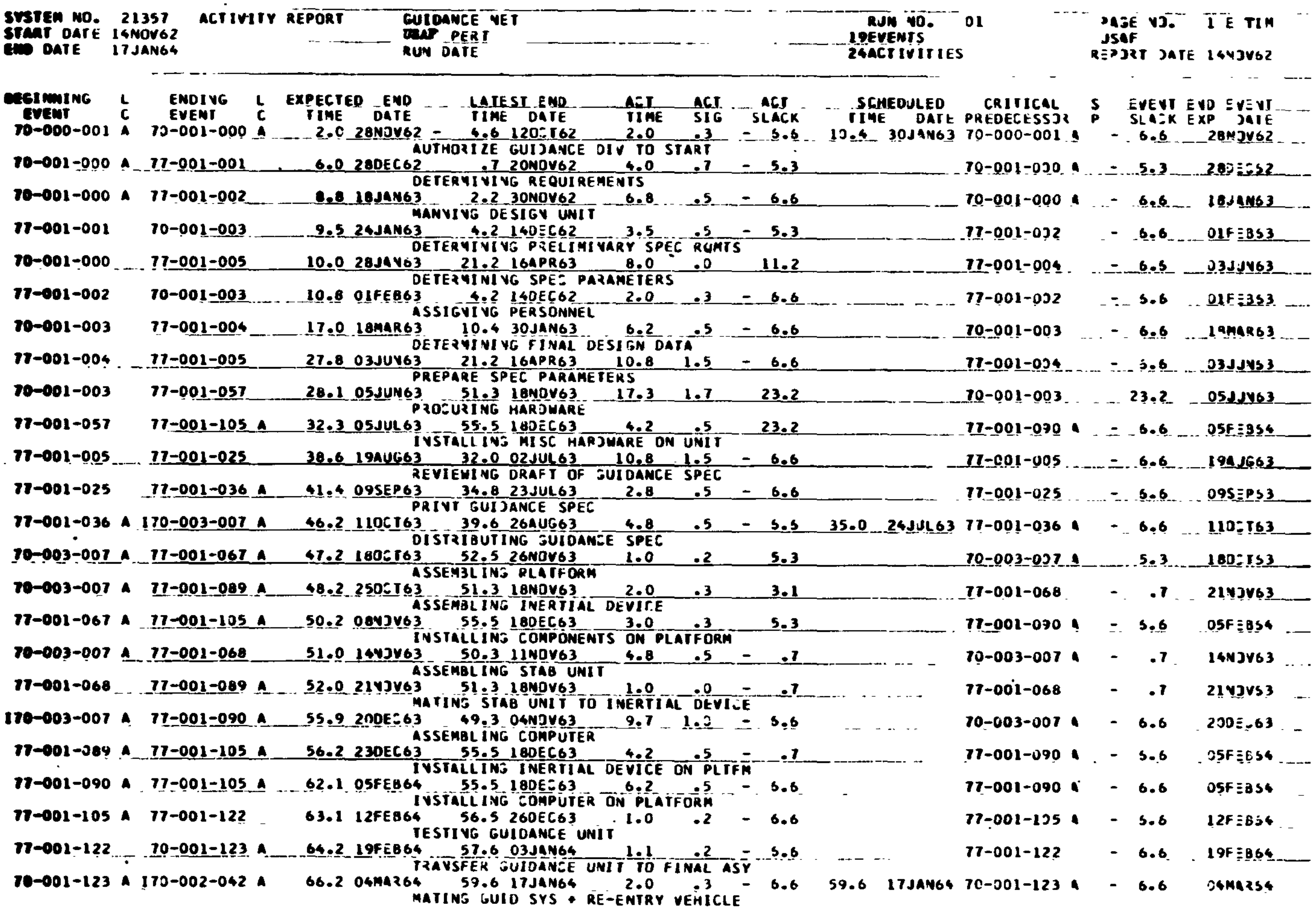
Figure A-15
Activity Report-EE-BE Sequence



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SYSTEM NO.  21357   ACTIVITY REPORT        GUIDANCE NET                                RUN NO.    01              PAGE NO.   1 E TIM
START DATE 14NOV62                         USAF PERT                                   19EVENTS                   JSAF
END DATE   17JAN64                         RUN DATE                                    24ACTIVITIES               REPORT DATE 14NOV62

BEGINNING  L    ENDING   L  EXPECTED END      LATEST END       ACT    ACT    ACT      SCHEDULED     CRITICAL     S   EVENT END EVENT
  EVENT    C    EVENT    C   TIME   DATE       TIME  DATE       TIME   SIG    SLACK    TIME    DATE PREDECESSOR  P   SLACK EXP  DATE
70-000-001 A  70-001-000 A    2.0 28NOV62 -   4.6 12OCT62      2.0     .3  -  5.6   10.4  30JAN63 70-000-001 A   -  6.6     28NOV62
                                           AUTHORIZE GUIDANCE DIV TO START
70-001-000 A  77-001-001      6.0 28DEC62      .7 20NOV62      4.0     .7  -  5.3                 70-001-000 A   -  5.3     28DEC62
                                           DETERMINING REQUIREMENTS
70-001-000 A  77-001-002      8.8 18JAN63     2.2 30NOV62      6.8     .5  -  6.6                 70-001-000 A   -  6.6     18JAN63
                                           MANNING DESIGN UNIT
77-001-001    70-001-003      9.5 24JAN63     4.2 14DEC62      3.5     .5  -  5.3                 77-001-002     -  6.6     01FEB63
                                           DETERMINING PRELIMINARY SPEC RQMTS
70-001-000    77-001-005     10.0 28JAN63    21.2 16APR63      8.0     .0    11.2                 77-001-004     -  6.6     03JUN63
                                           DETERMINING SPEC PARAMETERS
77-001-002    70-001-003     10.8 01FEB63     4.2 14DEC62      2.0     .3  -  6.6                 77-001-002     -  6.6     01FEB63
                                           ASSIGNING PERSONNEL
70-001-003    77-001-004     17.0 18MAR63    10.4 30JAN63      6.2     .5  -  6.6                 70-001-003     -  6.6     18MAR63
                                           DETERMINING FINAL DESIGN DATA
77-001-004    77-001-005     27.8 03JUN63    21.2 16APR63     10.8    1.5  -  6.6                 77-001-004     -  6.6     03JUN63
                                           PREPARE SPEC PARAMETERS
70-001-003    77-001-057     28.1 05JUN63    51.3 18NOV63     17.3    1.7    23.2                 70-001-003        23.2    05JUN63
                                           PROCURING HARDWARE
77-001-057    77-001-105 A   32.3 05JUL63    55.5 18DEC63      4.2     .5    23.2                 77-001-090 A   -  6.6     05FEB64
                                           INSTALLING MISC HARDWARE ON UNIT
77-001-005    77-001-025     38.6 19AUG63    32.0 02JUL63     10.8    1.5  -  6.6                 77-001-005     -  6.6     19AUG63
                                           REVIEWING DRAFT OF GUIDANCE SPEC
77-001-025    77-001-036 A   41.4 09SEP63    34.8 23JUL63      2.8     .5  -  6.6                 77-001-025     -  6.6     09SEP63
                                           PRINT GUIDANCE SPEC
77-001-036 A 170-003-007 A   46.2 11OCT63    39.6 26AUG63      4.8     .5  -  5.5   35.0  24JUL63 77-001-036 A   -  6.6     11OCT63
                                           DISTRIBUTING GUIDANCE SPEC
70-003-007 A  77-001-067 A   47.2 18OCT63    52.5 26NOV63      1.0     .2     5.3                 70-003-007 A      5.3     18OCT63
                                           ASSEMBLING PLATFORM
70-003-007 A  77-001-089 A   48.2 25OCT63    51.3 18NOV63      2.0     .3     3.1                 77-001-068     -   .7     21NOV63
                                           ASSEMBLING INERTIAL DEVICE
77-001-067 A  77-001-105 A   50.2 08NOV63    55.5 18DEC63      3.0     .3     5.3                 77-001-090 A   -  5.6     05FEB64
                                           INSTALLING COMPONENTS ON PLATFORM
70-003-007 A  77-001-068     51.0 14NOV63    50.3 11NOV63      4.8     .5  -   .7                 70-003-007 A   -   .7     14NOV63
                                           ASSEMBLING STAB UNIT
77-001-068    77-001-089 A   52.0 21NOV63    51.3 18NOV63      1.0     .0  -   .7                 77-001-068     -   .7     21NOV63
                                           MATING STAB UNIT TO INERTIAL DEVICE
170-003-007 A 77-001-090 A   55.9 20DEC63    49.3 04NOV63      9.7    1.3  -  5.6                 70-003-007 A   -  6.6     20DEC63
                                           ASSEMBLING COMPUTER
77-001-089 A  77-001-105 A   56.2 23DEC63    55.5 18DEC63      4.2     .5  -   .7                 77-001-090 A   -  5.6     05FEB64
                                           INSTALLING INERTIAL DEVICE ON PLTFM
77-001-090 A  77-001-105 A   62.1 05FEB64    55.5 18DEC63      6.2     .5  -  5.6                 77-001-090 A   -  6.6     05FEB64
                                           INSTALLING COMPUTER ON PLATFORM
77-001-105 A  77-001-122     63.1 12FEB64    56.5 26DEC63      1.0     .2  -  6.6                 77-001-105 A   -  5.6     12FEB64
                                           TESTING GUIDANCE UNIT
77-001-122    70-001-123 A   64.2 19FEB64    57.6 03JAN64      1.1     .2  -  5.6                 77-001-122     -  6.6     19FEB64
                                           TRANSFER GUIDANCE UNIT TO FINAL ASY
70-001-123 A 170-002-042 A   66.2 04MAR64    59.6 17JAN64      2.0     .3  -  6.6   59.6  17JAN64 70-001-123 A   -  6.6     04MAR64
                                           MATING GUID SYS + RE-ENTRY VEHICLE
```

Figure A-16
Activity Report-Expected Time Sequence

```
SYSTEM NO.  21357   ACTIVITY REPORT      GUIDANCE NET                        RUN NO.   01          PAGE NO.   1 A SLK
START DATE 14NOV62                       USAF PERT                           19EVENTS              USAF
END DATE    17JAN64                      RUN DATE                            24ACTIVITIES          REPORT DATE 14NOV62

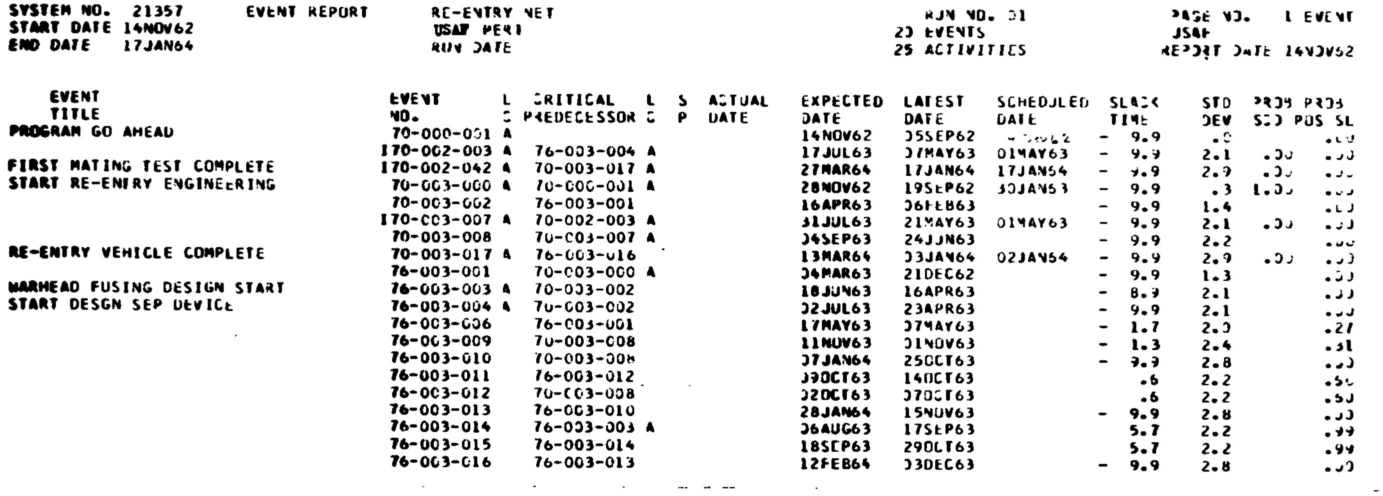
BEGINNING   L    ENDING    L  EXPECTED  END    LATEST END    ACT    ACT    ACT     SCHEDULED   CRITICAL     S  EVENT END EVENT
 EVENT      C    EVENT     C    TIME   DATE    TIME  DATE    TIME   SIG   SLACK    TIME   DATE PREDECESSOR  P  SLACK EXP  DATE
 70-000-001 A  70-001-000 A     2.0 28NOV62 -   4.6 12OCT62   2.0    .3   - 6.6   10.4  30JAN63 70-000-001 A  -   5.6    28NOV62
                                         AUTHORIZE GUIDANCE DIV TO START
170-003-007 A  77-001-090 A    55.9 20DEC63    49.3 04NOV63   9.7   1.0   - 6.6                 70-003-007 A  -   6.6    20DEC63
                                         ASSEMBLING COMPUTER
 70-001-000 A  77-001-002       8.8 18JAN63     2.2 30NOV62   6.8    .5   - 6.6                 70-001-000 A  -   6.6    18JAN63
                                         MANNING DESIGN UNIT
 77-001-090 A  77-001-105 A    62.1 05FEB64    55.5 18DEC63   6.2    .5   - 6.6                 77-001-090 A  -   6.6    05FEB64
                                         INSTALLING COMPUTER ON PLATFORM
 70-001-123 A 170-002-042 A    66.2 04MAR64    59.6 17JAN64   2.0    .3   - 6.6   59.6  17JAN64 70-001-123 A  -   5.6    04MAR64
                                         MATING GUID SYS + RE-ENTRY VEHICLE
 77-001-002    70-001-003      10.8 01FEB63     4.2 14DEC62   2.0    .3   - 6.6                 77-001-002    -   6.6    01FEB63
                                         ASSIGNING PERSONNEL
 70-001-003    77-001-004      17.0 18MAR63    10.4 30JAN63   6.2    .5   - 6.6                 70-001-003    -   6.6    18MAR63
                                         DETERMINING FINAL DESIGN DATA
 77-001-004    77-001-005      27.8 03JUN63    21.2 16APR63  10.8   1.5   - 6.6                 77-001-004    -   6.6    03JUN63
                                         PREPARE SPEC PARAMETERS
 77-001-122    70-001-123 A    64.2 19FEB64    57.6 03JAN64   1.1    .2   - 6.6                 77-001-122    -   6.6    19FEB64
                                         TRANSFER GUIDANCE UNIT TO FINAL ASY
 77-001-105 A  77-001-122      63.1 12FEB64    56.5 26DEC63   1.0    .2   - 6.6                 77-001-105 A  -   6.6    12FEB64
                                         TESTING GUIDANCE UNIT
 77-001-005    77-001-025      38.6 19AUG63    32.0 02JUL63  10.8   1.5   - 6.6                 77-001-005    -   5.6    19AUG63
                                         REVIEWING DRAFT OF GUIDANCE SPEC
 77-001-025    77-001-036 A    41.4 09SEP63    34.8 23JUL63   2.8    .5   - 5.6                 77-001-025    -   6.6    09SEP63
                                         PRINT GUIDANCE SPEC
 77-001-036 A 170-003-007 A    46.2 11OCT63    39.6 26AUG63   4.8    .5   - 6.5   35.0  24JUL63 77-001-036 A  -   6.6    11OCT63
                                         DISTRIBUTING GUIDANCE SPEC
 77-001-001    70-001-003       9.5 24JAN63     4.2 14DEC62   3.5    .5   - 5.3                 77-001-002    -   6.6    01FEB63
                                         DETERMINING PRELIMINARY SPEC RQMTS
 70-001-000 A  77-001-001       6.0 28DEC62      .7 20NOV62   4.0    .7   - 5.3                 70-001-000 A  -   5.3    28DEC62
                                         DETERMINING REQUIREMENTS
 77-001-089 A  77-001-105 A    56.2 23DEC63    55.5 18DEC63   4.2    .5   -  .7                 77-001-090 A  -   6.6    05FEB64
                                         INSTALLING INERTIAL DEVICE ON PLTFM
 70-003-007 A  77-001-068      51.0 14NOV63    50.3 11NOV63   4.8    .5   -  .7                 70-003-007 A  -    .7    14NOV63
                                         ASSEMBLING STAB UNIT
 77-001-068    77-001-089 A    52.0 21NOV63    51.3 18NOV63   1.0    .0   -  .7                 77-001-068    -    .7    21NOV63
                                         MATING STAB UNIT TO INERTIAL DEVICE
 70-003-007 A  77-001-089 A    48.2 25OCT63    51.3 18NOV63   2.0    .3     3.1                 77-001-068    -    .7    21NOV63
                                         ASSEMBLING INERTIAL DEVICE
 77-001-067 A  77-001-105 A    50.2 08NOV63    55.5 18DEC63   3.0    .3     5.3                 77-001-090 A  -   6.6    05FEB64
                                         INSTALLING COMPONENTS ON PLATFORM
 70-003-007 A  77-001-067 A    47.2 18OCT63    52.5 26NOV63   1.0    .2     5.3                 70-003-007 A      5.3    18OCT63
                                         ASSEMBLING PLATFORM
 70-001-000    77-001-005      10.0 28JAN63    21.2 16APR63   8.0    .0    11.2                 77-001-004    -   6.6    03JUN63
                                         DETERMINING SPEC PARAMETERS
 70-001-003    77-001-057      28.1 05JUN63    51.3 16NOV63  17.3   1.7    23.2                 70-001-003       23.2    05JUN63
                                         PROCURING HARDWARE
 77-001-057    77-001-105 A    32.3 05JUL63    55.5 18DEC63   4 2    .5    23.2                 77-001-090 A  -   6.6    05FEB64
                                         INSTALLING MISC HARDWARE ON UNIT
```

Figure A-17
Activity Report-Slack Sequence

```
SYSTEM NO.  21357      EVENT REPORT      AIRFRAME NET                                      RUN NO. 01              PAGE NO.    1 EVENT
START DATE 14NOV62                       USAF  PERT                                     28 EVENTS                  USAF
END DATE    15JUN64                      RUN DATE                                       35 ACTIVITIES              REPORT DATE 14NOV62

   EVENT                                EVENT        L  CRITICAL     L  S  ACTUAL   EXPECTED  LATEST    SCHEDULED  SLACK    STD   PROB PROB
   TITLE                                NO.          C  PREDECESSOR  C  P  DATE     DATE      DATE      DATE       TIME     DEV   SCD POS SL
PROGRAM GO AHEAD                        70-000-001   A                              14NOV62   27SEP62              - 6.7     .0          .13
START AIRFRAME ENGINEERING              70-002-000   A  70-000-001   A              28NOV62   11OCT62   30JAN63    - 6.7     .3   1.00   .13
AIRFRAME REV SYS INTERFACE SPEC APP    I70-002-003   A  71-002-002   A              05MAY63   20MAR63   01MAY63    - 6.7     .8    .23   .13
FIRST MATING TEST COMPLETE             I70-002-042   A  71-002-015                  04DEC63   16DEC63   17JAN64      1.6    1.6   1.00   .77
TEST VEHICLE ON DOCK                    70-002-051   A  71-002-050                  03AUG64   15JUN64   15JUN64    - 6.7    5.8    .13   .13
INTERFACE DATA AVAILABLE               I70-003-007   A  70-002-003   A              20MAY63   24JUL63   24JUL63      9.0     .9   1.00  1.00
                                        71-002-001      70-002-000   A              28JAN63   10DEC62              - 6.7     .3          .13
AIRFRAME MOCK-UP COMPLETE               71-002-002   A  71-002-001                  12MAR63   24JAN63              - 6.7     .6          .13
                                        71-002-004      70-002-003   A              24MAY63   06JUN63                1.6     .9          .77
                                        71-002-005      71-002-004                  14JUN63   26JUN63                1.6    1.0          .77
                                        71-002-006      71-002-005                  12JUL63   24JUL63                1.6    1.1          .77
                                        71-002-007      71-002-006                  20SEP63   02OCT63                1.6    1.5          .77
                                        71-002-008      71-002-006                  26JUL63   22OCT63               12.1    1.1         1.00
                                        71-002-009      71-002-006                  03OCT63   22OCT63                2.6    1.6          .69
                                        71-002-010      71-002-006                  09AUG63   15OCT63                9.2    1.7         1.00
                                        71-002-011      71-002-007                  31OCT63   12NOV63                1.6    1.6          .77
                                        71-002-012      70-002-003   A              16JUL63   17SEP63                8.8    1.3         1.00
                                        71-002-013      71-002-012                  19AUG63   21OCT63                8.8    1.4         1.00
                                        71-002-014      71-002-011                  05NOV63   15NOV63                1.6    1.6          .77
                                        71-002-015      71-002-014                  26NOV63   09DEC63                1.6    1.6          .77
                                        71-002-043      70-002-042   A              12FEB64   24FEB64                1.6    1.9          .77
                                        71-002-044      70-002-042   A              04FEB64   13MAR64                5.6    1.8          .99
                                        71-002-045      71-002-046                  03JAN64   12MAR64                9.8    1.6         1.00
                                        71-002-046      70-002-042   A              26DEC63   05MAR64                9.8    1.6         1.00
                                        71-002-047      71-002-043                  17MAR64   27MAR64                1.5    2.0          .77
ENG REL SEP CONNECTORS                  71-002-048   A  70-002-003   A              13MAY63   27MAR63              - 6.7     .8          .13
                                        71-002-049      71-002-048   A              28MAY64   10APR64              - 6.7    5.8          .13
                                        71-002-050      71-002-049                  05JUN64   17APR64              - 6.7    5.8          .13
```

Figure A-18
Airframe Event Report-Event Number Sequence



```
SYSTEM NO.  21357      EVENT REPORT      RE-ENTRY NET                              RUN NO. 01              PAGE NO.   1 EVENT
START DATE 14NOV62                       USAF PERT                               20 EVENTS                USAF
END DATE    17JAN64                      RUN DATE                                25 ACTIVITIES            REPORT DATE 14NOV62

    EVENT                                EVENT       L  CRITICAL    L  S  ACTUAL   EXPECTED  LATEST   SCHEDULED  SLACK    STD  PROB PROB
    TITLE                                NO.         C  PREDECESSOR C  P  DATE     DATE      DATE     DATE       TIME     DEV  SCD  POS SL
PROGRAM GO AHEAD                          70-000-001 A                             14NOV62   05SEP62  [illegible] -  9.9   .0        .00
                                         170-002-003 A  76-003-004 A               17JUL63   07MAY63  01MAY63    -  9.9   2.1  .00  .00
FIRST MATING TEST COMPLETE               170-002-042 A  70-003-017 A               27MAR64   17JAN64  17JAN64    -  9.9   2.9  .00  .00
START RE-ENTRY ENGINEERING                70-003-000 A  70-000-001 A               28NOV62   19SEP62  30JAN63    -  9.9    .3 1.00  .00
                                          70-003-002    76-003-001                 16APR63   06FEB63             -  9.9   1.4       .00
                                         170-003-007 A  70-002-003 A               31JUL63   21MAY63  01MAY63    -  9.9   2.1  .00  .00
                                          70-003-008    70-003-007 A               04SEP63   24JUN63             -  9.9   2.2       .00
RE-ENTRY VEHICLE COMPLETE                 70-003-017 A  76-003-016                 13MAR64   03JAN64  02JAN64    -  9.9   2.9  .00  .00
                                          76-003-001    70-003-000 A               04MAR63   21DEC62             -  9.9   1.3       .00
WARHEAD FUSING DESIGN START               76-003-003 A  70-003-002                 18JUN63   16APR63             -  8.9   2.1       .00
START DESGN SEP DEVICE                    76-003-004 A  70-003-002                 02JUL63   23APR63             -  9.9   2.1       .00
                                          76-003-006    76-003-001                 17MAY63   07MAY63             -  1.7   2.0       .27
                                          76-003-009    70-003-008                 11NOV63   01NOV63             -  1.3   2.4       .31
                                          76-003-010    70-003-008                 07JAN64   25OCT63             -  9.9   2.8       .00
                                          76-003-011    76-003-012                 09OCT63   14OCT63                 .6   2.2       .50
                                          76-003-012    70-003-008                 02OCT63   07OCT63                 .6   2.2       .50
                                          76-003-013    76-003-010                 28JAN64   15NOV63             -  9.9   2.8       .00
                                          76-003-014    76-003-003 A               06AUG63   17SEP63                5.7   2.2       .99
                                          76-003-015    76-003-014                 18SEP63   29OCT63                5.7   2.2       .99
                                          76-003-016    76-003-013                 12FEB64   03DEC63             -  9.9   2.8       .00
```

Figure A-19
Re-entry Event Report-Event Number Sequence

]

```
PERT MASTER FILE REPORT                                                                                     PAGE    1

TC  SP SCH    BEG EVENT LC   END EVENT LC  OPT TIME   MEAN  TIME    PESS TIME SCH DATE ACT DATE  EVENT TITLE
       OPT                                                                    / 1 / 2 / 3 / 4   /ACTIVITY TITLE

 3                           70.000.001 A                                     11.14.62          PROGRAM GO AHEAD
 1            70.000.001 A   70.001.000 A      1.1        2.0          2.9     1.30.63          START GUIDANCE ENGINEERING
 1            77.001.105 A   70.001.123 A      1.2        2.1          3.0                      GUIDANCE SYS COMPLETE
 1            70.000.001 A   70.002.000 A      1.1        2.0          2.9     1.30.63          START AIRFRAME ENGINEERING
 1            71.002.002 A   70.002.003 A      6.3        7.8          9.3     5.01.63          AIRFRAME REV SYS INTERFACE SPEC APP
 1            76.003.003 A   70.002.003 A      2.1        3.0          3.9     5.01.63
 1            76.003.004 A   70.002.003 A      1.1        2.0          2.9     5.01.63
 1            70.001.123 A   70.002.042 A      1.1        2.0          2.9     1.17.64          FIRST MATING TEST COMPLETE
 1            70.002.003 A   70.002.042 A     25.0       29.5         34.0     1.17.64          FIRST MATING TEST COMPLETE
 1            70.003.017 A   70.002.042 A      1.1        2.0          2.9     1.17.64          FIRST MATING TEST COMPLETE
 1            70.002.042 A   70.002.051 A     21.3       25.5         29.7     6.15.64          TEST VEHICLE ON DOCK
 1            71.002.048 A   70.002.051 A     45.2       62.3         79.4     6.15.64          TEST VEHICLE ON DOCK
 1            70.000.001 A   70.003.000 A      1.1        2.0          2.9     1.30.63          START RE-ENTRY ENGINEERING
 1            70.002.003 A   70.003.007 A      1.1        2.0          2.9     7.24.63
 1            77.001.036 A   70.003.007 A      3.3        4.8          6.3     7.24.63          INTERFACE DATA AVAILABLE
 1            70.003.007 A   70.003.017 A     25.2       31.5         37.8     1.02.64          RE-ENTRY VEHICLE COMPLETE
 1            70.002.000 A   71.002.002 A     12.7       14.2         15.7                      AIRFRAME MOCK-UP COMPLETE
 1            70.002.003 A   71.002.048 A      1.0        1.0          1.0                      ENG REL SEP CONNECTORS
 1            70.003.000 A   76.003.003 A     22.0       28.0         34.0                      WARHEAD FUSING DESIGN START
 1            70.003.000 A   76.003.004 A     24.0       30.0         36.0                      START DESGN SEP DEVICE
 1            70.001.000 A   77.001.036 A     32.5       39.4         46.3                      GUIDANCE SPEC COMPLETE
 1            70.003.007 A   77.001.067 A       .4        1.0          1.6                      COMPLETE PLATFORM ASSEMBLY
 1            70.003.007 A   77.001.089 A      4.3        5.8          7.3                      INERTIAL DEVICE COMPLETE
 1            70.003.007 A   77.001.090 A      6.7        9.7         12.7                      COMPUTER COMPLETE
 1            77.001.067 A   77.001.105 A      2.1        3.0          3.9                      FIRST GUID.UNIT ASSEMBLED
 1            77.001.089 A   77.001.105 A      2.7        4.2          5.7                      FIRST GUID.UNIT ASSEMBLED
 1            77.001.090 A   77.001.105 A      4.7        6.2          7.7                      FIRST GUID.UNIT ASSEMBLED
```

Figure A-20
Integrated Summary Master File Report

```
SYSTEM NO.  21357      EVENT REPORT       INTEGRATED NETWORK                        RUN NO. 01              PAGE NO.    1 EDATE
START DATE 14NOV62                        USAF PERT                                19 EVENTS                 USAF
END DATE    15JUN64                       RUN DATE                                 26 ACTIVITIES             REPORT DATE 14NOV62

    EVENT                                EVENT      L  CRITICAL    L  S  ACTUAL   EXPECTED  LATEST   SCHEDULED  SLACK     STD  PROB PROB
    TITLE                                NO.        C PREDECESSOR  C  P  DATE     DATE      DATE     DATE       TIME      DEV  SCD  POS SL
PROGRAM GO AHEAD                         70-000-001 A                             14NOV62   22MAY62             - 24.6    .0          .00
START GUIDANCE ENGINEERING               70-001-000 A  70-000-001  A              28NOV62   06JUN62  30JAN63    - 24.6    .3   1.00   .00
START RE-ENTRY ENGINEERING               70-003-000 A  70-000-001  A              28NOV62   01AUG62  30JAN63    - 16.7    .3   1.00   .01
START AIRFRAME ENGINEERING               70-002-000 A  70-000-001  A              28NOV62   11OCT62  30JAN63    -  6.7    .3   1.00   .13
AIRFRAME MOCK-UP COMPLETE                71-002-002 A  70-002-000  A              12MAR63   24JAN63             -  6.7    .6          .13
WARHEAD FUSING DESIGN START              76-003-003 A  70-003-000  A              18JUN63   27FEB63             - 15.7   2.0          .01
START DESGN SEP DEVICE                   76-003-004 A  70-003-000  A              02JUL63   06MAR63             - 16.7   2.0          .01
AIRFRAME REV SYS INTERFACE SPEC APP      70-002-003 A  76-003-004  A              17JUL63   20MAR63  01MAY63    - 16.7   2.0    .00   .01
ENG REL SEP CONNECTORS                   71-002-048 A  70-002-003  A              24JUL63   27MAR63             - 16.7   2.0          .01
GUIDANCE SPEC COMPLETE                   77-001-036 A  70-001-000  A              09SEP63   15MAR63             - 24.6   2.3          .00
INTERFACE DATA AVAILABLE                 70-003-007 A  77-001-036  A              11OCT63   18APR63  24JUL63    - 24.6   2.4    .00   .00
COMPLETE PLATFORM ASSEMBLY               77-001-067 A  70-003-007  A              18OCT63   24OCT63                 .8   2.4          .60
INERTIAL DEVICE COMPLETE                 77-001-089 A  70-003-007  A              21NOV63   16OCT63             -  5.2   2.5          .04
COMPUTER COMPLETE                        77-001-090 A  70-003-007  A              20DEC63   02OCT63             - 11.1   2.6          .00
FIRST GUID.UNIT ASSEMBLED                77-001-105 A  77-001-090  A              05FEB64   14NOV63             - 11.1   2.6          .00
GUIDANCE SYS COMPLETE                    70-001-123 A  77-001-105  A              19FEB64   02DEC63             - 11.1   2.6          .00
RE-ENTRY VEHICLE COMPLETE                70-003-017 A  70-003-007  A              25MAY64   02DEC63  02JAN64    - 24.6   3.2    .00   .00
FIRST MATING TEST COMPLETE               70-002-042 A  70-003-017  A              09JUN64   16DEC63  17JAN64    - 24.6   3.2    .00   .00
TEST VEHICLE ON DOCK                     70-002-051 A  70-002-042  A              08DEC64   15JUN64  15JUN64    - 24.6   3.5    .00   .00
```

Figure A-21
Integrated Summary Event Report-Expected Date Sequence

APPENDIX B

QUESTIONS AND ANSWERS

APPENDIX B

QUESTIONS AND ANSWERS

The following questions and answers are included to supplement the text. The questions were selected from those asked during the informal discussion period of the USAF PERT Computer Conference held at Wright-Patterson AFB in January, 1963. Only those questions which are still applicable to the current program are included. The answers have been edited so that these also pertain to the current program. It is hoped that these questions and answers might help emphasize and/or further clarify parts of the preceding text.

QUESTION: How do you specify the holidays which the computer should consider?
ANSWER: The computer will accept up to 3 holidays per month. There are 6 holidays in the program now. One can add other holidays up to 3 per month.

QUESTION: Could the program accommodate a two-week shut-down period for vacation?
ANSWER: The program does not presently allow for this accommodation, so you would have to trick the program to build it in. You could accomplish this by putting in a dummy activity for this two-week vacation period with everything leading into and out of this activity. It would delay your network for two weeks. The calendar routine might be modified to accommodate such a period.

QUESTION: Which programs require modification to permit running of USAF PERT on a 10 tape 7090?
ANSWER: There are 3 versions of the program (16, 14 or 12 tape version). A 10 tape version could be accomplished by program modification.

QUESTION: Can ASD provide specific guidance or assistance to installations for modifications?
ANSWER: As far as modifications go, we will make them as requested by the PERT Control Board. On other modifications for individuals, we would give you as much advice as possible but will not make modifications for specific individuals. We have no plans for anything like this.

QUESTION: If you use 12,000 events you will have 12,000 activities. Will the computer process this data?
ANSWER: Yes, since the program will accept up to 12,000 events and up to 12,000 activities. However, most networks have more activities than events, so the activity limit of 12,000 is usually reached first.

QUESTION: Will the computer list beginning and ending events to allow checking for hanging events?
ANSWER: We do not require that these be flagged and hence could not distinguish between legitimate beginning and ending events and hanging events. We felt that flagging these would be a burden on the user. Multiple starts and ends seem to be a worthwhile feature.

QUESTION: Are completed activities ever dropped from the program by the new master file that is prepared? If not, it must take as long to run a network the first time as the last when most activities are completed.
ANSWER: Completed activities are not automatically dropped. However, they can be deleted with transaction 5 code.

QUESTION: Will a block diagram of the USAF PERT program be made available to users who wish to program for a different computer?
ANSWER: This manual includes our flow charts. We very seldom draw block diagrams, but have programmed from these written type descriptions.

QUESTION: Would you state the justification for using the 1401 in the system, rather than running entirely on the 7090?
ANSWER: We run primarily on the 7090 and use our 1401 as peripheral equipment. It is used only for card-to-tape and tape-to-print operations, and for one additional routine which is the shred-out program. The shred-out routine is relatively more efficient on the 1401 than doing it on the 7090.

QUESTION: What size 1401 is needed?
ANSWER: The very minimum 1401. The only requirement is that the 1401 program accept five lines per block (665 characters) for output. In the case of the 1401 shred-out routine two tapes are needed.

QUESTION: How do you change level codes for summarization?
ANSWER: A TC 2 code as described in the text can accomplish this.

QUESTION: What is the formula for computing the probability of positive slack?
ANSWER: The probability of positive slack is equal to the area under a normal curve (with a mean of zero and standard deviation of 1) from minus infinity up to the computed slack value. The computed slack value is equal to the event's expected time minus the event's latest time divided by the square root of the sum of the squares of the standard deviation associated with each of these times.

QUESTION: Does the summary computer output allow the generation of a summary network utilizing this computer information only? Please describe operation stops required to get printed summary output.
ANSWER: The summary output program produces cards that are identical to the regular input cards to the program. These cards can be listed on a 1401 or 407. You can integrate two or more summary card decks and get a master file, and all other PERT outputs of these integrated summary networks. This requires an additional 7090 computer run.

QUESTION: Do you plan to add the ability to handle multiple networks on a single tape?
ANSWER: This is under consideration.

QUESTION: How do you handle expected completion dates prior to the report date?
ANSWER: Expected completion dates which fall prior to the report date are not treated in any special way. The dates are computed and printed out in the event output as Expected Dates along with dates falling after the report date. The program does not assume an activity is completed until it is reported completed. If an activity has an expected end date prior to the report date, this date will still print out with that activity.

QUESTION: Do you have or plan to have a preprinted update sheet?
ANSWER: No. We will use the AFSC Form 30.

QUESTION: I assume there is no capability for using a moving "anchor date" so that estimates to complete are given on "activities in progress".
ANSWER: There are no plans to include this in the program.

QUESTION: Can you use one input card per activity, or do you have to use two?
ANSWER: You can use one or two. If you use activity nomenclature, it goes in the second card.

QUESTION: Can you put a schedule date on a terminal event without putting it on the activities leading into the event (for T_L computations)?
ANSWER: Yes, this is entered with a TC 3 code. You can enter any scheduled date with a TC 3 code.

QUESTION: Duplicate activities are dropped during input validation. If dates or time estimates are different on the two cards, which card will it accept?
ANSWER: It accepts the first card and drops the second one. If you wish to change the times on an activity, use a TC 2 code.

QUESTION: Is the input validation output (errors) printed on line or on tape?
ANSWER: No error that doesn't pertain to the operator is printed on line. Diagnostic comments are included with the normal output.

QUESTION: If the beginning event is 16, the ending event is 17, and the critical predecessor is 8, does activity slack refer to activity 16-17 or 8-17?
ANSWER: 16 to 17 for activity slack and 8 to 17 for event slack.

QUESTION: Can 50,000 events be grouped as four nets and processed via summarization and reprocessed automatically?
ANSWER: The technique of automatically dividing a large network, condensing the divided networks and then running the condensed networks together and integrating them as single networks is not available. One can achieve this same result by doing some of the work manually (grouping the original network into smaller ones, etc.).

QUESTION: How is it mathematically possible to arrive at a probability of 1.00 for positive slack?
ANSWER: With respect to a normal distribution with a standard deviation of one, a normalized slack value of greater than 2.78 will give a probability of 1.00. Theoretically we are off by perhaps 1%.

QUESTION: What does the probability of positive slack tell you that is meaningful? Manager viewpoint rather than technician.
ANSWER: In the past we have concerned ourselves in looking at the negative slack. It gives us a capability of looking at the other side of the coin about which we have been sort of ignorant in the past.
ANSWER: This will continue for sometime to be a developmental problem. Any manager wants to know when he will get well. To us this particular factor seems to have been derived in an intelligent manner. Better ones, however, may replace it. Later on, I think, we are going to have a better feel whether this is true or not. We consider that the probability of positive slack figure will become the most useful figure available from PERT. We believe managers will progressively want to have this figure at their disposal as they work with the system. If this does not prove true, it hasn't cost us much to get it.
ANSWER: The probability of positive slack is just one minus the probability of negative slack.

QUESTION: If the E-L output starts at run date, what happens to the E-L print-out of past due events?
ANSWER: The E-L Chart starts at the reporting date. All events prior to this date or beyond the limit of the chart will not be included in this output.

QUESTION: What is the essential difference between a transaction code 1 and a transaction code 9? If code 1 is an activity, why does it have event titles?
ANSWER: Transaction code 1 is for the initial input of an activity and includes all information about it except activity nomenclature and associated information. A 9 code is needed for this additional information. Had the need for activity nomenclature only been sufficient, we could have included that in a 1 code instead of event nomenclature.

QUESTION: If you can use 1 or 3 time estimates, how can your input be checked in these fields for validity?
ANSWER: If the first time field is blank, we assume a single time estimate has been given; otherwise, we assume and make a check on the three-time estimates.

QUESTION: Are the completed activities shown in the final output?
ANSWER: Yes, if you don't delete them. We don't automatically throw anything away.

QUESTION: Can T_E and T_L be printed out in weeks rather than dates?
ANSWER: They are printed out on the activity output in both weeks and dates.

QUESTION: Can scheduled dates be entered as elapsed times from base time rather than dates?
ANSWER: No, a scheduled date must be entered as a date.

QUESTION: Can completions be removed from the master tape as of Time Now? This would reduce 7090 time and voluminous printout paper, especially near the end of the program.
ANSWER: You have to delete them yourself. We do not do them automatically.

QUESTION: Do you have to put transaction code 5 ahead of other transaction codes when updating?
ANSWER: No, That was so on our other program but not on this program. They can be inserted anywhere.

QUESTION: Exactly what events are printed when a loop is discovered?
ANSWER: All events in the loop are now printed out.

QUESTION: One of the basic considerations in using or not using any particular computer program is economics. Do you have any information or actual experience comparing USAF PERT running time vs. running time for other PERT programs?
ANSWER: We can compare it to our old program which we have used over a year. The new program runs approximately twice as fast as the old program. Better Sort Routines, the use of IOCS and 9PAC systems were major contributions to this increased speed. We process about 300 activities per

minute. Hardly any program does exactly the same thing, so it is hard to accurately compare times with other programs.

QUESTION: Are there any problems in making simulated runs without destroying the original network?
ANSWER: No, all you have to do is not keep the update master file, but retain the old master file which will not be touched.

QUESTION: The handbook says the Base Date is 1 July 1945, in the BDOT routine; therefore, is it not the same as the START date?
ANSWER: In the programming section of the manual we talked about the base date for this particular routine. This is not the Base Date we have been talking about today. We reestablished a Base Date through this routine as the one given in the initial card (Start Date).

QUESTION: What if Saturdays are legal? What happens if you work six days a week?
ANSWER: We don't print out on Saturday. For example, when the 28th comes on Saturday, we print out 27 as the day. No provision is made for eliminating only Sunday and keeping Saturday.

QUESTION: When a time (T_E, T_L) falls on a weekend or holiday, which way does the program change the date?
ANSWER: If the time converted to a date falls on December 25th the program will print out the 24th of December.

QUESTION: We do not use IBSYS monitor. Will USAF PERT be available as a self-contained self-load package?
ANSWER: Presently, it isn't. I don't know the problems involved, but I cannot see an advantage to a self-contained self-load package. However, the program could be considered a self-contained self-load package by using two program types; one being the PERT program and the other the IBSYS program type.

QUESTION: Is SSD tied into USAF PERT?
ANSWER: SSD does not have a PERT staff or office as large as the other divisions. The COMSAT program is a new program that will be coming out and we intend to use USAF PERT on this. The TITAN III PERT Cost System is not wholly consistent with the DOD/NASA Guide. It was in existence

before the Guide was agreed to and published; and for this reason, we permitted it to continue in this manner, attempting to make it as compatible with the Guide as possible. It may be expected that SSD will use USAF PERT on other systems.

QUESTION: As a small contractor, how should you plan to furnish a PERT network so that it will be compatible with USAF PERT? I am talking about small contractors with small computers.
ANSWER: We would like to discuss the use of different computers and also the questions of switching from PERT I to USAF PERT piece by piece. I think we could give you a better answer later.

QUESTION: What coordination exists between the Navy Dahlgren PERT Cost effort, the NASA PERT Cost and USAF PERT Cost effort toward establishing one common PERT Cost system?
ANSWER: You should be reassured that these kinds of matters are coming up in the PERT Cost Technical Subgroup of the PERT Coordinating Group of the OSD. The coordination is improving all the time, and I think some policy will be forthcoming that will help.

QUESTION: What policy does AFSC feel will be adapted as applied to cost of PERT implementation? Is this to continue as a direct charge to the contract?
ANSWER: I think we had better consider the environment and purpose of PERT and PERT Cost. These are devices to improve management. There is widespread agreement in the Government that this kind of cost is closely associated with doing business. We are aware that you have to periodically modernize your EDP equipment as well as your management information systems. At this time the Air Force does not plan to carry a line item in the budget for the cost of PERT. We consider that we are buying management from the contractors and that one of their costs of doing business is the modernizing of machines and management systems. We are including provisions in our pilot tests of PERT Cost to accumulate the actual direct costs of the PERT Cost system.

QUESTION: How long do you think it will be before Industry can operate on a single PERT requirement and technique imposed by the Government?

ANSWER: I would not estimate; OSD and the three Services with NASA have been working very hard to prevent making the same mistakes that were perhaps made in the past. We are establishing milestones in the Coordinating Group, such as achieving uniformity of output, examining the input data and looking at product improvement procedures for the future. It is an important thing that the Government agencies are coming together and this portends great good for the future.

QUESTION: Will you describe briefly the major impact PERT Cost has on PERT Time?
ANSWER: I think there are several. First, the advent of the work breakdown structure is very useful in PERT Time as well as PERT Cost. Most people now agree that in any program the first step is to develop a work breakdown structure and then draw the network. Second, in PERT Cost the networks have activity orientation as well as event orientation. Although PERT Time was heading this way, it has been emphasized by PERT Cost. Lastly, in drawing networks you must include all of the cost generating activities. This doesn't give you a direct effect on PERT Time, but it will get you in the habit of drawing networks that are more complete and cover a larger portion of the work.
ANSWER: Also included in that list should be the effect of using schedules in PERT Time. The use of schedules in PERT Cost, rather than expected times, should be reflected in an increased use of schedules in many applications of PERT Time.

QUESTION: Will DOD establish a basic list of reporting milestones which will be standard as to nomenclature, definition and evidence of completion?
ANSWER: We are asking DOD the same question. They have an RDT&E study group working on this problem. We have indicated as an objective a network type approach to their various decisions, and the naming of general or standard milestones which will be looked at by each level of management.

QUESTION: What will be the attitude of USAF or DOD toward primes using a computer program other than USAF PERT but with similar output capability?

ANSWER: We are moving toward a uniformity of outputs from both PERT Time and PERT Cost. We will probably see the Government impose standard requirements for outputs regardless of the type of computer which the contractor will use. In the meantime we should make it clear that although we are going to encourage the adoption of USAF PERT within industry, there is no intention to require it across the board at this time.
ANSWER: If we standardize the output, we will see a number of different computer programs which will still produce the output. DOD of course will have to look at a Department-wide policy on how we are going to accept programs for various makes of computers. We cannot limit PERT to one computer program since not everyone will have the same type of computer. Although several organizations are writing programs for the same computer, there is such a good exchange of ideas we may end up with programs that are almost identical.

QUESTION: Many companies cannot afford or profitably use a 7090 for USAF PERT. Will the Air Force sponsor research for small computer, multi-pass programs?
ANSWER: If a company can't process its own data, one of our own Divisions will process it for them on the Air Force computers. As to sponsoring writing of additional computer programs, we have dollar restrictions. At the present time we have no plans to write a program for any other machines than those we use ourselves. The Air Force does have computers other than the 7090 which we may want to use. In these cases we will no doubt make the effort necessary to write another program. Obviously, other computer companies will write computer programs, and there are several programs along the same lines we are discussing here.

QUESTION: How does ASD feel about use of PERT techniques for small production runs - a network showing multiple end events such as delivery of Model Serial #1, #2, #3, etc.?
ANSWERS: We have done some thinking on production. We have looked at repetitive type work, and so have other people. One application which might be mentioned is missile site activation. The BSD site activation programs do have repetitive operations and have set up a standard network for a missile site operation. Thus, when you put in a squadron of missiles you can use the same network, even with the same event numbers, and code the networks to keep track of the same activities going on at different sites

at the same time. Similarly, we can see that there are applications on small production runs where you could do this. Particularly where there are a small number of high value items, such as in the RS-70 where there are three aircraft, it is straightforward to draw a single network for each one of these aircraft. Beyond such application, the only thinking we have done shows that obviously you can draw networks which include as events, delivery of item 1, delivery of lot 1, or delivery of lot 2. We have not gone much further than that.
ANSWER: The DOD has established a group similar to the PERT Coordinating Group to look at the Line-of-Balance technique, and part of their charter is the development of a uniform technique or system for monitoring the production phase of weapon system acquisition. We have come up with a similar concept on Line-of-Balance with cost, and you will be hearing more about this in the future.
ANSWER: Operation of PERT is the same. We feel it is excellent for once-through work. We feel, at this point, that more efficient means may be found where repetitive work is being done. We will not see PERT Cost or PERT Time as it looks today, being used in the production phase without some modification. We do expect rewarding results to follow from the techniques which the DOD Committee has just set up. The production flow charts become the networks, and we will be surprised if they do not resemble PERT Cost networks.
ANSWER: You cannot change the cost reporting principles as you go into production from research and development.

QUESTION: Do you consider PERT a system in itself or just a part of the total management system, or both?
ANSWER: PERT can be considered a system in itself, but it must be used as a part of the over-all management system if maximum benefit is to be derived from its use. PERT Time and PERT Cost should be integrated with the other aspects of management. The three basic parameters which a manager must consider are time, cost and product performance. Decisions cannot be made on time alone or time and cost alone without affecting the performance of a product. In the case of a weapon system development program, if the cost of the development program must be reduced, usually it can be accomplished only by reducing the performance of the weapon to be developed. Therefore, PERT can provide part of the information a manager needs

in evaluating alternatives, but it cannot be treated as an independent system.

QUESTION: What actual practical experience has anyone had in the application of PERT Cost to the area of raw material cost at the low level functional work package (cost center)? Specifically, how are normal total contract buys charged to each specific task? If this is merely allocated, does this dilute the prime purpose of better cost control?
ANSWER: The only practical experience in the area of raw materials handling as far as ASD is concerned has been on the TFX. The plan is to use material summary items at a low level in the work breakdown structure. When contract buys are made for different types of material the expenditure will be reported against a material summary item. For the purpose of showing in the PERT Cost reports the actual expenditure funds as the material is used, charges against work packages will accomplish a transfer of funds to the proper work breakdown item. This procedure is the most practical suggested to date to get the expenditure of funds into the PERT Cost reports at an early date.

QUESTION: Does the program allow for unreported events; i.e., events which should have happened by the report date but are neither reported as happened nor given new estimated date? Print-out on E-L chart would present a problem, for example.
ANSWER: The USAF PERT Program has been written to report an event accomplished only when all activities leading into that event have been reported as accomplished. The fact that the event date is prior to the reporting date does not automatically convert the event to the accomplished category. The program continues to carry this event without indication of accomplishment. However, the E-L graph does present a problem, in that the events scheduled to occur prior to the reporting date will not appear.

QUESTION: How do you by-pass chronological clock?
ANSWER: By punching a one (1) in column 23 of the initial card. However, it is not necessary to by-pass this. The date can be entered by IBSYS control card (date card).

QUESTION: What are off-line report printing specifications?
ANSWER: The output is blocked 5 lines per block. (Each line is 138 characters or less; 132 characters of these are print

information, and one is an end of record mark, and the other 5 are blank.) Any print routine for a minimum 1401 will print this providing that it takes care of the blocking.

QUESTION: Is there a reduced activity event capacity which uses only 12 tapes in normal operation?
ANSWER: No.

QUESTION: Can you mark classification on output sheets?
ANSWER: We use premarked classified paper. This paper is available on the market.

QUESTION: Can the program be changed to work on the IBM 704 or IBM 7044?
ANSWER: I believe this would be difficult and would involve extensive reprogramming.

QUESTION: If USAF PERT were written in Fortran there wouldn't be any problem running on other computers; is any consideration being given to changing from IBSYS FAP to Fortran?
ANSWER: We considered Fortran but decided that it was not advisable to program PERT in Fortran because of the resulting reductions in program capacity.

QUESTION: Can USAF PERT be run on an IBM 7094 under Fortran III FAP monitor? What changes would be necessary?
ANSWER: PERT can be run on a 7094 under IBSYS but not under Fortran FAP monitor.

QUESTION: Can USAF PERT be run with disk file storage? What changes would be necessary?
ANSWER: Changing from tape storage to disk storage would require very few changes, if any, according to IBM technical representatives and IBM literature.

QUESTIONS: If the report date is not of significance to a run, what do you do about an activity which was scheduled for and capable of starting prior to run date (all predecessors have been completed)? If no activity is assumed started until reported so, how will the program know the activity should have been reported and is now overdue, and how will you reflect this slippage in your expected project finish date?

ANSWER: The report date is of significance in the run. We identify and suspend such activities in relation to the as of date of the report when such action is required.

QUESTION: Is this program written for a 16K 8 tape AB&C channels 7090 or 7040?
ANSWER: The program is for a 32K 12 to 16 tape 7090 with two data channels and on-line printer.

QUESTION: Can several networks or projects be integrated into one network?
ANSWER: Yes.

QUESTION: What is a duplicate activity?
ANSWER: Duplicate activities are two activities that have the same beginning and ending event numbers.

QUESTION: Will several inputs be accepted on the same run for the same activity if the transaction codes are different?
ANSWER: Yes.

QUESTION: Does the 1401 sort actually re-sequence items or only select from the list sequence?
ANSWER: The shred-out routine only selects from the list sequence.

APPENDIX C

CHANGES AND CORRECTIONS TO THE USAF PERT PROGRAM

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CHANGES AND CORRECTIONS TO THE USAF PERT PROGRAM

Since the release of the Computer Program Handbook, AFSC PERT III, in December, 1962[1], the following changes and corrections have been made and are now included in the USAF PERT TIME program. These changes have been included in this volume.

1. A transaction code of 2 (TC equals 2) can be used to change interface flags and/or level codes. If columns 5, 14, 15 and 24 are blank, nothing is done to the interface flags or level codes. A zero in any one of these columns will delete the corresponding interface flag or level code. An "I" in columns 5 or 15 will add an interface flag for the corresponding event. To change an interface flag or level code, this 2 code must contain the same activity as was used initially to establish a new interface flag and/or level code. If the level code or interface flag was assigned to an event more than once, a 2 code must be used with each activity that contained the flag or code.

2. A transaction code of 6 (TC equals 6) is used to add an actual date and if desired to add a title to the beginning event of the network. The date must be later than the start date of the system. If only the event title is to be added, a TC 3 code should be used. The only information which a TC 6 card needs is the event number in columns 16-23, the actual date in the date field (columns 37-42) and if included, the title in columns 44-78 together with a "6" in column 1.

3. When a level code is give to an event, it will appear with that event each time the event appears in the event outputs and the E-L chart. But in the activity outputs and master file report, it will print only with the activity that it appeared with on the input card. This does not affect computations in any way.

[1] Title changed to USAF PERT, Volume II, USAF PERT TIME SYSTEM COMPUTER HANDBOOK.

4. In the master file, the headings PREC EVENT and SUCC EVENT now print as BEGINNING EVENT and ENDING EVENT.

5. The heading EVENT NOMENCLATURE has been changed to EVENT TITLE in the event output and master file report.

6. When ERROR is printed in the slack column of the event and/or activity output, nothing is printed in the latest date and/or latest end time-date columns. The date that previously was printed had no meaning. Also in the E-L chart, when the slack is in error, the line reserved for the latest date is omitted.

7a. Vertical columns of periods are printed at 5 week intervals on the E-L chart to aid in reading the output.

b. An option to delete the D's from the chart has been added.

c. An E-L chart by months, extending from the report date to 84 months, is now available.

8. The ACTIVITY TITLE and the activity associated information fields are now printed together in the master file without any spaces between them.

9. When an event is given an interface flag (I), this is printed out immediately preceding the event number in all event outputs.

10. When the scheduled date option is selected for a scheduled date, an asterisk is printed immediately preceding the scheduled date in both the event and activity outputs. The scheduled date then becomes one of the constraints in computing the latest date. It will not necessarily be the constraining time.

11. When the activity expected date or the end event expected date is an actual date, an "A" will precede it on the activity report.

The following four items refer to the summary output option:

12. The summary output routine computes and punches three time estimates for each of its activities. These time estimates are computed from a single time estimate E and a standard deviation S. The optimistic time equals (E - 3S) and the pessimistic time equals (E + 3S). When the value (E - 3S) defined above is negative the optimistic time is set to zero and the pessimistic time is set to 2E. The possibility of a negative time was previously overlooked and caused an error.

13. All events with scheduled dates and with the scheduled date option selected are included in the summary network.

14. A new date routine is now in the program.

15. The output from the summary routine includes event titles.

APPENDIX D

GLOSSARY OF SYMBOLS, STANDARD ABBREVIATIONS, AND TERMS

APPENDIX D

GLOSSARY OF SYMBOLS, STANDARD ABBREVIATIONS, AND TERMS

SYMBOLS

A = An abbreviation for T_A used in graphic reports.

a = Optimistic time estimate for an activity.

b = Pessimistic time estimate for an activity.

BE = Beginning event.

DPA = Designated Processing Agency.

E = An abbreviation for T_E used in graphic reports.

EE = Ending event.

L = An abbreviation for T_L used in graphic reports.

LC = Level code.

m = Most likely time estimate for an activity.

S = An abbreviation for T_S used in graphic reports.

S_E = Earliest completion date for an activity.

S_L = Latest completion date for an activity.

SP = Short path flag.

SPO = System Program Office.

T_A = Actual date on which an event occurs or an activity is completed.

T_D = Directed date for an event.

T_E = Expected date for an event (based on t_e).

t_e = Expected elapsed time for an activity.

T_L = Latest allowable date for an event (based on t_e).

t_s = Scheduled elapsed time for an activity.

T_S = Scheduled completion date for an activity or event.

σ = (sigma) Mathematical symbol for standard deviation.

STANDARD ABBREVIATIONS

Following is a recommended list of abbreviations intended for use in describing events and activities in PERT networks. The list is compatible with and includes the more common abbreviations extracted from AFM 11-2 "Air Force Manual of Abbreviations."

WORD	ABBREVIATION
Accept, Acceptance	acc
Acceptance Test	acc tst
Acceptance Test Procedure	acc tst procd
Acceptance Test Specification	acc tst spec
Activity	acty
Activation	activ
Actuator	actr
Acquisition	acqn
Aerospace Ground Equipment	AGE
Aerospace Vehicle Equipment	AVE
After	aft
Air Force	AF
Air Force Logistics Command	AFLC
Air Force Plant Representative	AFPR
Air Force Systems Command	AFSC
Air Force Manual	AFM
Air to Air	A/A
Air to Ground	A/G
Air Training Command	ATC
Airborne Intercept	AI
Airborne Missile Control System	AMCS
Airborne Support Equipment	ASE
Aircraft	A/C
Alternating Current	AC

WORD	ABBREVIATION
Alternator, Alternate	altn
Altitude	alt
Analysis, Analyze, Analyzer	anlys
Annex	anx
Antenna	ant
Approval, Approve, Approved	appr
Approximate	aprx
Assemble, Assembly	asbly
Assembly Drawing	asbly dwg
Authenticate, Authenticated, Authority	auth
Authorized	authzd
Automatic	auto
Automatic Frequency Control	AFC
Auxiliary	aux
Auxiliary Power Supply	APS

WORD	ABBREVIATION
Auxiliary Power Unit	APU
Available	avail
Award, Awarded	awd
Battery	btry
Beacon	bcn
Bearing	brg
Begin	bgn
Block	blk
Block House	BH
Board	bd
Bomb-Navigation	B/N
Bottom	bot
Branch	brch
Bread Board	BB
Building	bldg
Bundle	bdl
Cables	ca
Calibration	calbr
Captive Dummy Missile	CDM

WORD	ABBREVIATION
Captive Electrical Missile	CEM
Captive Mechanical Missile	CMM
Category	cat
Cathode Ray Tube	CRT
Checkout	C/O
Circuit	ckt
Clear	clr
Command Receiver/ Reply Transmitter	CR/RT
Communication	comm
Complete	C
Contract	contr
Contract Technical Compliance Inspection	CTCI
Control	ctl
Delivery	dlvr
Design	dsgn
Development Engineering Inspection	DEI
Drawing	dwg
Electric	elec
Electronic Counter Measure	ecm
Electronic Data Processing	EDP
Electronics	elct
Emplacement	empl
Engine	eng
Engineer, Engineering	engr
Equipment	eqp
Estimated Time of Completion	etc
Field	fld
Fiscal Year	fy
Forward	fwd
Freight	frt
Frequency Modulation	FM
From	frm
Functional	fn
Generator	gen
Ground Electronics Engineering & Installations Agency	GEEIA

WORD	ABBREVIATION
Ground to Air	G/A
Ground Zero	gz
Guidance	guid
Guided Aircraft Missile	gam
Guided Aircraft Rocket	gar
Guided Launch	GL
Hardstand	hs
Hardware	hrdw
Heavy	hvy
High Frequency	HF
Home on Jamming	HOJ
Human Factors	HFac
Hydraulic	hyd
Hydraulic Power Unit	hpu
Identification Friend or Foe	IFF
In Accordance With	iaw
Infrared	IR
Initiate	init
Inspection	insp
Installation, Install	instl
Instrumentation	instrum
Integrate-Assemble-Checkout	IAC
Integration	int
Interim Missile Auxiliaries	IMA
Intermediate Frequency	IF
Jet-Assisted Take-off	Jato
Light	lt
Liquid	liq
Logistic	log
Logistic Support Manager	LSM
Machine	mach
Maintenance Bench	MB
Man Hours	Man hr

WORD	ABBREVIATION
Management	mgt
Manager	mgr
Manufacture, Manufacturing	mfg
Masonry	msry
Master Equipment Allowance List	MEAL
Material	matl
Material Release Order	MRO
Megacycle	mc
Memorandum	memo
Missile	msl
Missile Internal Power Supply	MIPS
Missile Power Unit	MPU
Missile Tracker	MT
Modification	mod
Motor	mtr
Motor Case	mc
Nomenclature	nomen
Nozzle	noz

WORD	ABBREVIATION
Number	nr
Operating Location	ol
Package	pkg
Periodic	perdc
Personnel	pers
Phase	ph
Plan	pln
Planning	plng
Power	pwr
Preliminary	prel
Prepare	prep
Presentation & Control System	PCS
Primary	prim
Printout	P/O
Priority	prior
Procedure	procd
Procure, Procurement	proc
Production	pdn
Program	prog
Programmed Launch Missile	PLM

WORD	ABBREVIATION
Propellant	propl
Property	ppty
Proposal	prop
Propulsion	prpln
Provision	prov
Publication	pub
Pulse Doppler	PD
Purchase Order	PO
Qualification, Qualify	qual
Radio	rdo
Radio Frequency	RF
Range	rg
Receive	rcv
Recommend	rcmd
Re-Entry Vehicle	REV
Release	rel
Reliability	relia
Request for Quotation	RFQ
Requirement	requ
Requisition	rqn
Research	rsch
Review	rev
Runway	rnwy
Schedule	sched
Security	sec
Seeker	skr
Segment	seg
Shipment	shpmt
Special List of Equipment	Sloe
Specification	spec
Staging Area	Stg ar
Standard	std
Standard Nomenclature List	snl
Start	S
Storage	stg
Strategic Air Command	SAC
Subcontractor Start	SS
Submit	subm

WORD	ABBREVIATION
Substitute	subst
Subsystems	subs
Super Charger	sup chg
Surface-to-Air-Missile	sam
System	sys
System-Analysis	SA
System Auxiliaries	saux
System Lab	SL
System Test	ST
Tactical Air Command	TAC
Tactical Missile	tm
Tactical Test Equipment	TTE
Technical	tech
Technical Bulletin	TB
Technical Manual	TM
Temporary	tmpry
Tentative	tntv

WORD	ABBREVIATION
Training	tng
Transmit	xmit
Truck	trk
Vehicle	veh
Verify	vfy
Visual	vis
Warehouse	whse
Weapon	wpn
Wing	wg
Year	yr
Zone	Z

TERMS

Activity

A work effort of a program which is represented on a network by an arrow. An activity may also simply represent a connection or interdependency between two events in the network. An activity cannot be started until the event preceding it has occurred.

Activity Report

A printout listing activities and related data by activity (EE-BE), activity expected end time and/or activity slack, depending on the code placed in Column 80 of the initial input card.

Activity Slack (See Slack.)

Actual Date (T_A)

The calendar date on which an event occurred or an activity was completed. This date must not be later than the report date and the beginning event must have occurred.

Beginning Event (BE) (Predecessor Event)

An event which signifies the beginning of one or more activities on a network.

Completion Date (See Actual Date.)

Constraint

The relationship of an event to a succeeding activity wherein an activity may not start until the event preceding it has occurred. The term "constraint" is also used to indicate the relationship of an activity to a succeeding event wherein an event cannot occur until all activities preceding it have been completed.

Critical Path

That particular sequence of events and activities in a path that has the greatest negative or least positive slack; therefore, the longest path through the network.

Critical Predecessor

The event which immediately precedes the event under consideration on the most time-consuming path leading to that event.

Dangling Event

Any event other than the start or end events that has either no predecessor or no successor.

Designated Processing Agency

The military or civilian computer facility which processes the program data.

Detailed Network

A network which reflects activities at the lowest level of the program breakdown. Detailed networks, while remaining an operating tool of the responsible organization, are related to the program breakdown structure, and their status is reflected in the Program Management Network.

Directed Date for an Event (T_D)

Date for a specific accomplishment formally directed by the contracting authority. A schedule date (T_S) which has been formally specified by contracting authority.

E-L Chart

A report showing a chronological display of the expected time (E), the latest time (L), the scheduled time (S) and the actual time (A) for events.

Earliest Completion Date (S_E)

The expected completion date for an activity. This date is calculated by:

- summing the scheduled elapsed times (t_s) for activities on the longest path from the beginning of the program to the end of the activity; and
- then adding this sum to the calendar start date of the program.

For distant time effort where scheduled elapsed times (t_s) have not been established, expected elapsed times (t_e) will be used to calculate S_E .

End Event

That event which signifies the completion of a path through a network.

Ending Event (EE) (Successor)

The event which signifies the completion of one or more activities.

Error Report

A list received with the computer printouts which includes identification of data input errors recognized by the computer.

Event

A specific definable accomplishment in a program plan, recognizable at a particular instant in time. Events do not consume time or resources.

Event Number

A unique number assigned to each event in the network.

Event Report

A computer printout listing events and related data in event number, expected date, or event slack sequence, dpending on the code placed in Column 21 of the initial input card.

Event Slack (See Slack.)

Expected Date (T_E)

The calendar date on which an event is expected to occur. It is calculated by adding to the date of each start event or completed event of the network activity times along each possible path up to the event under consideration. The latest of these computed dates is the expected date of completion for the event.

Expected Elapsed Time (t_e)

A statistically weighted average time estimate, incorporating the optimistic (a), most likely (m), and pessimistic (b) time estimates for the work to be accomplished:

$$t_e = \frac{a + 4m + b}{6}$$

Interface Event

An event which signals the necessary transfer of responsibility, end items, or information from one part of the program effort to another. Examples of interface events are the receipt of an item (hardware, drawing, specification), or the release of engineering drawings to manufacturing.

Latest Allowable Date (T_L)

The latest date on which an event can occur without creating an expected delay in the completion of the program. The T_L value for a given event is calculated by subtracting the sum of the expected elapsed activity times (t_e) for the activities on the longest path from the given event to the end event of the program from the latest date allowable for completing the program.

Latest Completion Date (S_L)

The latest calendar date on which an activity can be scheduled for completion without creating an expected delay in the completion of the program. This date is calculated by:

- summing the scheduled elapsed times(t_s) for activities on the longest path from end of the activity to the end of the program; and

- then subtracting this sum from the calendar end date of the program.

For distant time effort where scheduled elapsed times (t_s) have not been established, expected elapsed times (t_e) will be used to calculate S_L.

Level Code

A letter (A through O only) that is associated with an event for shredout purposes or summarization.

Master File

A file containing all information for a network.

Master File Report

A listing of all events/activities and associated information for an entire network (printed by request only).

Master File Report Summary Sheet

Information received with each computer output to identify the user, system number, output heading, report date, start date of the computations and types of reports to be generated by the computer. (Initial card data from the Form 30.)

Milestone

Synonymous with an event in a network.

Most Likely Time Estimate (m)

The most realistic estimate of the time an activity might consume. This time would be expected to occur most often if the activity could be repeated numerous times under similar circumstances.

Network

A flow diagram consisting of the activities and events which must be accomplished to reach the program objectives, showing their planned sequence of accomplishment, interdependencies, and interrelationships.

Network Integration

The joining of networks by interfacing to produce a master network reflecting the total program.

Network Summarization

A process of reducing detailed networks to a skeletal or summary network for reporting purposes.

Node

An event with two or more preceding events.

Optimistic Time Estimate (a)

The time in which the activity can be completed if everything goes exceptionally well. It is estimated that an activity would have no more than one chance in a hundred of being completed within this time.

Pessimistic Time Estimate (b)

An estimate of the longest time an activity would require under the most adverse conditions, barring acts of God.

Predecessor Event (See Beginning Event.)

Probability of Meeting Scheduled Date

A probability derived from normal probability tables with the entering argument being the event scheduled date in weeks minus the event expected date in weeks divided by the event standard deviation in weeks.

Program

For the purpose of this manual, defined as the total planned undertaking directed toward accomplishing a specific objective. The end items of a program can be a weapon system, an equipment, or a development objective.

Program Breakdown Structure (See Work Breakdown Structure.)

Program Management Network

A network reflecting the total program acquisition plan containing a level of detail required by the Program Manager for overall planning and control of the entire program.

Program Manager

The person assigned the prime responsibility for overall management of a program, such as a Program Director (SPD) of a SPO or a Project Officer.

Scheduled Completion Date (T_S)

A date assigned for completion of an activity (accomplishment of an event) for purposes of planning and control within an organization. Where no specific date is assigned, $S_E = T_S$.

Scheduled Elapsed Time (t_s)

The period of time assigned for performing an activity.

Scheduling

Determination and assignment of scheduled time to events and activities as compared to "expected time" resulting from network computations.

Short Path Flag

A flag assigned to all activities leading to a common end event. The minimum time through these activities instead of the maximum time will be taken as the end event's expected date.

Shredout

The extraction of selected items of pertinent data from the basic computed date for reporting to specific functions areas of levels of management interest.

Simulation

The processing of alternative actions to determine the effect such actions would have on the program concerned.

Slack

Activity Slack - The activity's latest end time minus its expected end time. The activity slack is always greater than or equal to the slack of the activity's ending event.

Event Slack - The time difference between the latest and expected dates for an event (T_L - T_E).

Slack may be positive, zero, or negative.

Standard Deviation of an Activity (σ)

A measure of variance about the expected elapsed time for an activity, calculated when using three time estimates. It is computed from the formula $\frac{b - a}{6}$.

Standard Deviation of an Event

A measure of variance about the event expected date. It is calculated by computing the square root of the sum of the squares of the activity standard deviations on the longest time path leading to the event under consideration.

Successor Event (See Ending Event.)

Summary Network

A network which represents, with a reduced number of selected events, the relationship of the events to each other and all of the significant characteristics of the detailed network. Lines connecting events on a summarized network are not necessarily true, definable work activities, since they are used to portray only the interdependencies and constraints among selected activities.

Transaction Code

A one-digit numeric character which indicates action is to be taken to process data from the input card.

Variance of an Activity (σ^2)

The square of the activity standard deviation.

Variance of an Event

The sum of the activity variances along the most time-consuming path leading to the referenced event.

Work Breakdown Structure

A family tree subdivision of a program, beginning with the end objectives and continuing with subdivision of these objectives into successively smaller end items. The work breakdown structure establishes the framework for:

- defining the work to be accomplished;
- constructing a network plan;
- summarizing the cost and schedule status of a program for progressively higher levels of management.

Zero-Time Activity

An activity which constrains the completion of the event to which it leads by requiring that the event from which it proceeds be completod first. No elapsed time is associated with it; i.e., the time estimate is zero.